

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30				1. REQUISITION NUMBER PR-CI-03-10779		PAGE 1 OF	
2. CONTRACT NO.		3. AWARD/EFFECTIVE DATE		4. ORDER NUMBER		5. SOLICITATION NUMBER PR-CI-03-10779	
						6. SOLICITATION ISSUE DATE 06/19/2003	
7. FOR SOLICITATION INFORMATION CALL:		a. NAME SCOTT THARP				b. TELEPHONE NUMBER (No collect calls) (513) 487-2092	
						8. OFFER DUE DATE/LOCAL TIME 7/25/2003 12:00 PM	
9. ISSUED BY Environmental Protection Agency Contracts Management Division 4411 Montgomery Road Norwood, OH 45212		CODE		10. THIS ACQUISITION IS <input checked="" type="checkbox"/> UNRESTRICTED <input type="checkbox"/> SET ASIDE: % FOR <input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> SMALL DISADV. BUSINESS <input type="checkbox"/> 8(A) NAICS: 334519 SIZE STANDARD: 500		11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED <input type="checkbox"/> SEE SCHEDULE <input type="checkbox"/> 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700) 13b. RATING 14. METHOD OF SOLICITATION <input type="checkbox"/> RFQ <input type="checkbox"/> IFB <input checked="" type="checkbox"/> RFP	
15. DELIVER TO		CODE		16. ADMINISTERED BY		CODE	
17a. CONTRACTOR/OFFEROR		CODE		FACILITY CODE		18a. PAYMENT WILL BE MADE BY	
						CODE	
						Environmental Protection Agency Research Triangle Park Financial Management Center (D143-02) Research Triangle Park, NC 27711	
TELEPHONE NO.							
<input type="checkbox"/> 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER				18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED <input type="checkbox"/> SEE ADDENDUM			
19. ITEM NO.		20. SCHEDULE OF SUPPLIES/SERVICES		21. QUANTITY		22. UNIT	
		SEE ATTACHED DOCUMENTS <i>(Attach Additional sheets as Necessary)</i>					
25. ACCOUNTING AND APPROPRIATION DATA N/A						26. TOTAL AWARD AMOUNT (For Govt. Use Only)	
<input type="checkbox"/> 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 ARE ATTACHED. <input type="checkbox"/> ARE <input type="checkbox"/> ARE NOT ATTACHED.							
<input type="checkbox"/> 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4. FAR 52.212-5 IS ATTACHED. ADDENDA <input type="checkbox"/> ARE <input type="checkbox"/> ARE NOT ATTACHED.							
28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN COPIES <input type="checkbox"/> TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.				29. AWARD OF CONTRACT: REFERENCE _____ OFFER <input type="checkbox"/> DATED _____, YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:			
30a. SIGNATURE OF OFFEROR/CONTRACTOR				31a. UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)			
30b. NAME AND TITLE OF SIGNER (TYPE OR PRINT)				30c. DATE SIGNED		31b. NAME OF CONTRACTING OFFICER (TYPE OR PRINT)	
						31c. DATE SIGNED	
						DAVID H. PLAGGE	
32a. QUANTITY IN COLUMN 21 HAS BEEN				33. SHIP NUMBER		34. VOUCHER NUMBER	
<input type="checkbox"/> RECEIVED <input type="checkbox"/> INSPECTED <input type="checkbox"/> ACCEPTED AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED				<input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL		35. AMOUNT VERIFIED CORRECT FOR	
32b. SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE				32c. DATE		36. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	
						37. CHECK NUMBER	
						38. S/R ACCOUNT NUMBER	
						39. S/R VOUCHER NUMBER	
						40. PAID BY	
41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT				42a. RECEIVED BY (Print)			
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER				42b. RECEIVED AT (Location)			
				42c. DATE REC'D (YY/MM/DD)		42d. TOTAL CONTAINERS	

AUTHORIZED FOR LOCAL REPRODUCTION

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BURDEN STATEMENTSTANDARD FORM 1449 (10-95)
Prescribed by GSA - FAR (48 CFR) 53.212

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OMB NO: 9000-0136
Expires: 09/30/98

TABLE OF CONTENTS

1.	CONTRACT TERMS AND CONDITIONS -- COMMERCIAL ITEMS (FAR 52.212-4) (FEB 2002) DEVIATION	Page 4
2.	CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS -- COMMERCIAL ITEMS (FAR 52.212-5) (APR 2003) .	Page 9
3.	INSTRUCTIONS TO OFFERORS -- COMMERCIAL ITEMS (FAR 52.212-1) (OCT 2000)	Page 13
4.	EVALUATION -- COMMERCIAL ITEMS (FAR 52.212-2) (JAN 1999) . . .	Page 17
5.	OFFEROR REPRESENTATIONS AND CERTIFICATIONS -- COMMERCIAL ITEMS (FAR 52.212-3) (JUL 2002)	Page 18
	ADDENDUM TO FAR CLAUSE 52.212-4	Page 1-1
1.	EVALUATION OF OPTIONS (FAR 52.217-5) (JUL 1990)	Page 1-2
2.	PERIOD OF PERFORMANCE (EP 52.212-140) (APR 1984)	Page 1-2
3.	TECHNICAL QUESTIONS (EP 52.215-110) (APR 1984)	Page 1-2
4.	OPTION FOR INCREASED QUANTITY--FIXED-PRICE CONTRACT (EP 52.217-982) (APR 1984)	Page 1-2
5.	CONTRACT ADMINISTRATION REPRESENTATIVES (EP 52.242-100) (AUG 1984)	Page 1-3
6.	SITE VISIT ARRANGEMENTS AND AVAILABILITY (GSA T024) (JUL 1994)	Page 1-3
	STATEMENT OF WORK	Page 2-1
	Page 2-52
	TECHNICAL PROPOSAL INSTRUCTIONS	Page 3-1
	TECHNICAL EVALUATION CRITERIA	Page 4-1
	QUALITY ASSURANCE PLAN	Page 5-1
	CONTRACT LINE ITEMS	Page 6-1

1. CONTRACT TERMS AND CONDITIONS -- COMMERCIAL ITEMS (FAR 52.212-4) (FEB 2002) DEVIATION

(a) *Inspection/Acceptance.* The Contractor shall only tender for acceptance those items that conform to the requirements of this contract. The Government reserves the right to inspect or test any supplies or services that have been tendered for acceptance. The Government may require repair or replacement of nonconforming supplies or reperformance of nonconforming services at no increase in contract price. The Government must exercise its post-acceptance rights --

(1) Within a reasonable time after the defect was discovered or should have been discovered; and

(2) Before any substantial change occurs in the condition of the item, unless the change is due to the defect in the item.

(b) *Assignment.* The Contractor or its assignee may assign its rights to receive payment due as a result of performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency in accordance with the Assignment of Claims Act (31 U.S.C.3727). However, when a third party makes payment (e.g., use of the Governmentwide commercial purchase card), the Contractor may not assign its rights to receive payment under this contract.

(c) *Changes.* Changes in the terms and conditions of this contract may be made only by written agreement of the parties.

(d) *Disputes.* This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613). Failure of the parties to this contract to reach agreement on any request for equitable adjustment, claim, appeal or action arising under or relating to this contract shall be a dispute to be resolved in accordance with the clause at FAR 52.233-1, Disputes, which is incorporated herein by reference. The Contractor shall proceed diligently with performance of this contract, pending final resolution of any dispute arising under the contract.

(e) *Definitions.* The clause at FAR 52.202-1, Definitions, is incorporated herein by reference.

(f) *Excusable delays.* The Contractor shall be liable for default unless nonperformance is caused by an occurrence beyond the reasonable control of the Contractor and without its fault or negligence such as, acts of God or the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, unusually severe weather, and delays of common carriers. The Contractor shall notify the Contracting Officer in writing as soon as it is reasonably possible after the commencement of any excusable delay, setting forth the full particulars in connection therewith, shall remedy such occurrence with all reasonable dispatch, and shall promptly give written notice to the Contracting Officer of the cessation of such occurrence.

(g) *Invoice.* (1) The Contractor shall submit an original invoice and three copies (or electronic invoice, if authorized) to the address designated in the contract to receive invoices. An invoice

must include--

- (i) Name and address of the Contractor;
- (ii) Invoice date and number;
- (iii) Contract number, contract line item number and, if applicable, the order number;
- (iv) Description, quantity, unit of measure, unit price and extended price of the items delivered;
- (v) Shipping number and date of shipment, including the bill of lading number and weight of shipment if shipped on Government bill of lading;
- (vi) Terms of any discount for prompt payment offered;
- (vii) Name and address of official to whom payment is to be sent;
- (viii) Name, title, and phone number of person to notify in event of defective invoice; and
- (ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.
- (x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision, contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(2) INVOICE PREPARATION AND SUBMISSION

Contractors shall submit invoices upon delivery and acceptance of all supplies or services unless otherwise specified in the contract. Invoices shall be submitted as follows:

One (1) original and two (2) copies of the invoice to:

**U.S. Environmental Protection Agency
Research Triangle Park Financial Management Center
(Mail Code D143-02)
Research Triangle Park, NC 27711**

One (1) copy of the invoice to the Project Officer designated in the clause entitled "Contract Administration Representatives" (EP 52.242-100).

One (1) copy of the invoice to the Contracting Officer designated in the clause entitled "Contract Administration Representatives" (EP 52.242-100).

(3) Invoices will be handled in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) prompt payment regulations at 5 CFR part 1315.

(h) *Patent indemnity.* The Contractor shall indemnify the Government and its officers, employees and agents against liability, including costs, for actual or alleged direct or contributory infringement of, or inducement to infringe, any United States or foreign patent, trademark or copyright, arising out of the performance of this contract, provided the Contractor is reasonably notified of such claims and proceedings.

(i) *Payment.* Payment shall be made for items accepted by the Government that have been delivered to the delivery destinations set forth in this contract. The Government will make payment in accordance with the Prompt Payment Act (31 U.S.C. 3903) and OMB prompt payment regulations at 5 CFR part 1315. In connection with any discount offered for early payment, time shall be computed from the date of the invoice. For the purpose of computing the discount earned, payment shall be considered to have been made on the date which appears on the payment check or the specified payment date if an electronic funds transfer payment is made.

(j) *Risk of loss.* Unless the contract specifically provides otherwise, risk of loss or damage to the supplies provided under this contract shall remain with the Contractor until, and shall pass to the Government upon:

(1) Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or

(2) Delivery of the supplies to the Government at the destination specified in the contract, if transportation is f.o.b. destination.

(k) *Taxes.* The contract price includes all applicable Federal, State, and local taxes and duties.

(l) *Termination for the Government's convenience.* The Government reserves the right to terminate this contract, or any part hereof, for its sole convenience. In the event of such termination, the Contractor shall immediately stop all work hereunder and shall immediately cause any and all of its suppliers and subcontractors to cease work. Subject to the terms of this contract, the Contractor shall be paid a percentage of the contract price reflecting the percentage of the work performed prior to the notice of termination, plus reasonable charges the Contractor can demonstrate to the satisfaction of the Government using its standard record keeping system, have resulted from the termination. The Contractor shall not be required to comply with the cost accounting standards or contract cost principles for this purpose. This paragraph does not give the Government any right to audit the Contractor's records. The Contractor shall not be paid for any work performed or costs incurred which reasonably could have been avoided.

(m) *Termination for cause.* The Government may terminate this contract, or any part hereof, for cause in the event of any default by the Contractor, or if the Contractor fails to comply with any contract terms and conditions, or

fails to provide the Government, upon request, with adequate assurances of future performance. In the event of termination for cause, the Government shall not be liable to the Contractor for any amount for supplies or services not accepted, and the Contractor shall be liable to the Government for any and all rights and remedies provided by law. If it is determined that the Government improperly terminated this contract for default, such termination shall be deemed a termination for convenience.

(n) *Title*. Unless specified elsewhere in this contract, title to items furnished under this contract shall pass to the Government upon acceptance, regardless of when or where the Government takes physical possession.

(o) *Warranty*. The Contractor warrants and implies that the items delivered hereunder are merchantable and fit for use for the particular purpose described in this contract.

(p) *Limitation of liability*. Except as otherwise provided by an express warranty, the Contractor will not be liable to the Government for consequential damages resulting from any defect or deficiencies in accepted items.

(q) *Other compliances*. The Contractor shall comply with all applicable Federal, State and local laws, executive orders, rules and regulations applicable to its performance under this contract.

(r) *Compliance with laws unique to Government contracts*. The Contractor agrees to comply with 31 U.S.C. 1352 relating to limitations on the use of appropriated funds to influence certain Federal contracts; 18 U.S.C. 431 relating to officials not to benefit; 40 U.S.C. 327, et seq., Contract Work Hours and Safety Standards Act; 41 U.S.C. 51-58, Anti-Kickback Act of 1986; 41 U.S.C. 265 and 10 U.S.C. 2409 relating to whistleblower protections; 49 U.S.C. 40118, Fly American; and 41 U.S.C. 423 relating to procurement integrity.

(s) *Order of precedence*. Any inconsistencies in this solicitation or contract shall be resolved by giving precedence in the following order:

- (1) The schedule of supplies/services.
- (2) The Assignments, Disputes, Payments, Invoice, Other Compliances, and Compliance with Laws Unique to Government Contracts paragraphs of this clause.
- (3) The clause at 52.212-5.
- (4) Addenda to this solicitation or contract, including any license agreements for computer software.
- (5) Solicitation provisions if this is a solicitation.
- (6) Other paragraphs of this clause.
- (7) The Standard Form 1449.
- (8) Other documents, exhibits, and attachments.
- (9) The specification.

2. CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS -- COMMERCIAL ITEMS (FAR 52.212-5) (APR 2003)

a) The Contractor shall comply with the following FAR clauses, which are incorporated in this contract by reference, to implement provisions of law or executive orders applicable to acquisitions of commercial items:

(1) 52.222-3, Convict Labor (E.O. 11755);

(2) 52.233-3, Protest after Award (31 U.S.C 3553).

(b) The Contractor shall comply with the FAR clauses in this paragraph (b) that the contracting officer has indicated as being incorporated in this contract by reference to implement provisions of law or Executive orders applicable to acquisitions of commercial items or components:

(Contracting Officer must check as appropriate.)

 X (1) 52.203-6, Restrictions on Subcontractor Sales to the Government, with Alternate I (41 U.S.C. 253g and 10 U.S.C. 2402).

 (2) 52.219-3, Notice of HUBZone Small Business Set-Aside (Jan 1999).

 X (3) 52.219-4, Notice of Price Evaluation Preference for HUBZone Small Business Concerns (Jan 1999) (if the offeror elects to waive the preference, it shall so indicate in its offer).

 (4) (i) 52.219-5, Very Small Business Set-Aside (Pub. L. 103-403, section 304, Small Business Reauthorization and Amendments Act of 1994).

 (ii) Alternate I to 52.219-5.

 (iii) Alternate II to 52.219-5.

 X (5) 52.219-8, Utilization of Small Business Concerns (15 U.S.C. 637 (d)(2) and (3)).

 (6) 52.219-9, Small Business Subcontracting Plan (15 U.S.C. 637 (d)(4)).

 (7) 52.219-14, Limitations on Subcontracting (15 U.S.C. 637(a)(14)).

 X (8) (i) 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323) (if the offeror elects to waive the adjustment, it shall so indicate in its offer).

 X (ii) Alternate I of 52.219-23.

 (9) 52.219-25, Small Disadvantaged Business Participation Program-Disadvantaged Status and Reporting (Pub. L. 103-355, section 7102, and 10 U.S.C. 2323).

 (10) 52.219-26, Small Disadvantaged Business Participation Program-Incentive Subcontracting (Pub. L. 103-355, section 7102, and 10 U.S.C.

2323).

X (11) 52.222-21, Prohibition of Segregated Facilities (Feb 1999).

X (12) 52.222-26, Equal Opportunity (E.O. 11246).

X (13) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (38 U.S.C. 4212).

X (14) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793).

X (15) 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (38 U.S.C. 4212).

X (16) 52.222-19, Child Labor-Cooperation with Authorities and Remedies (E.O. 13126).

___ (17)(i) 52.223-9, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (42 U.S.C. 6962(c)(3)(A)(ii)).

___ (ii) Alternate I of 52.223-9 (42 U.S.C. 6962(i)(2)(C)).

___ (18) 52.225-1, Buy American Act--Supplies (41 U.S.C. 10a-10d).

___ (19)(i) 52.225-3, Buy American Act--North American Free Trade Agreement--Israeli Trade Act (41 U.S.C. 10a-10d, 19 U.S.C. 3301 note, 19 U.S.C. 2112 note).

___ (ii) Alternate I of 52.225-3.

___ (iii) Alternate II of 52.225-3.

X (20) 52.225-5, Trade Agreements (19 U.S.C. 2501, et seq., 19 U.S.C. 3301 note).

X (21) 52.225-13, Restriction on Certain Foreign Purchases (E.O. 12722, 12724, 13059, 13067, 13121, and 13129).

___ (22) 52.225-15, Sanctioned European Union Country End Products (E.O. 12849).

___ (23) 52.225-16, Sanctioned European Union Country Services (E.O. 12849).

___ (24) 52.232-33, Payment by Electronic Funds Transfer-Central Contractor Registration (31 U.S.C. 3332).

X (25) 52.232-34, Payment by Electronic Funds Transfer-Other Than Central Contractor Registration (31 U.S.C. 3332).

___ (26) 52.232-36, Payment by Third Party (31 U.S.C. 3332).

___ (27) 52.239-1, Privacy or Security Safeguards (5 U.S.C. 552a).

___ (28) (i) 52.247-64, Preference for Privately Owned U.S.-Flag

Commercial Vessels (46 U.S.C. 1241).

___ (ii) Alternate I of 52.247-64.

(c) The Contractor shall comply with the FAR clauses in this paragraph (c), applicable to commercial services, which the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or executive orders applicable to acquisitions of commercial items or components:

(Contracting Officer must check as appropriate.)

___ (1) 52.222-41, Service Contract Act of 1965, As Amended (41 U.S.C. 351, et seq.).

___ (2) 52.222-42, Statement of Equivalent Rates for Federal Hires (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (3) 52.222-43, Fair Labor Standards Act and Service Contract Act -- Price Adjustment (Multiple Year and Option Contracts) (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (4) 52.222-44, Fair Labor Standards Act and Service Contract Act -- Price Adjustment (29 U.S.C. 206 and 41 U.S.C. 351, et seq.).

___ (5) 52.222-47, SCA Minimum Wages and Fringe Benefits Applicable to Successor Contract Pursuant to Predecessor Contractor Collective Bargaining Agreement (CBA) (41 U.S.C. 351, et seq.).

(d) *Comptroller General Examination of Record.* The Contractor shall comply with the provisions of this paragraph (d) if this contract was awarded using other than sealed bid, is in excess of the simplified acquisition threshold, and does not contain the clause at 52.215-2, Audit and Records -- Negotiation.

(1) The Comptroller General of the United States, or an authorized representative of the Comptroller General, shall have access to and right to examine any of the Contractor's directly pertinent records involving transactions related to this contract.

(2) The Contractor shall make available at its offices at all reasonable times the records, materials, and other evidence for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in FAR Subpart 4.7, Contractor Records Retention, of the other clauses of this contract. If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement. Records relating to appeals under the disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(3) As used in this clause, records include books, documents, accounting procedures and practices, and other data, regardless of type and regardless of form. This does not require the Contractor to create or maintain any record that the Contractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) Notwithstanding the requirements of the clauses in paragraphs (a), (b), (c) or (d) of this clause, the Contractor is not required to include any FAR clause, other than those listed below (and as may be required by an addenda to this paragraph to establish the reasonableness of prices under Part 15), in a subcontract for commercial items or commercial components --

(1) 52.222-26, Equal Opportunity (E.O. 11246);

(2) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (38 U.S.C. 4212);

(3) 52.222-36, Affirmative Action for Workers with Disabilities (29 U.S.C. 793);

(4) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (46 U.S.C. Appx 1241 and 10 U.S.C. 2631) (flow down required in accordance with paragraph (d) of FAR clause 52.247-64); and

(5) 52.222-41, Service Contract Act of 1965, As Amended (41 U.S.C. 351, *et seq.*).

3. INSTRUCTIONS TO OFFERORS -- COMMERCIAL ITEMS (FAR 52.212-1) (OCT 2000)

(a) *North American Industry Classification System (NAICS) code and small business size standard.* The NAICS code and small business size standard for this acquisition appear in Block 10 of the solicitation cover sheet (SF 1449). However, the small business size standard for a concern which submits an offer in its own name, but which proposes to furnish an item which it did not itself manufacture, is 500 employees.

(b) *Submission of offers.* Submit signed and dated offers to the office specified in this solicitation at or before the exact time specified in this solicitation. Offers may be submitted on the SF 1449, letterhead stationery, or as otherwise specified in the solicitation. As a minimum, offers must show--

- (1) The solicitation number;
- (2) The time specified in the solicitation for receipt of offers;
- (3) The name, address, and telephone number of the offeror;
- (4) A technical description of the items being offered in sufficient detail to evaluate compliance with the requirements in the solicitation. This may include product literature, or other documents, if necessary;
- (5) Terms of any express warranty;
- (6) Price and any discount terms;
- (7) "Remit to" address, if different than mailing address;
- (8) A completed copy of the representations and certifications at FAR 52.212-3;
- (9) Acknowledgment of Solicitation Amendments;
- (10) Past performance information, when included as an evaluation factor, to include recent and relevant contracts for the same or similar items and other references (including contract numbers, points of contact with telephone numbers and other relevant information); and
- (11) If the offer is not submitted on the SF 1449, include a statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation. Offers that fail to furnish required representations or information, or reject the terms and conditions of the solicitation may be excluded from consideration.

(c) *Period for acceptance of offers.* The offeror agrees to hold the prices in its offer firm for 30 calendar days from the date specified for receipt of offers, unless another time period is specified in an addendum to the solicitation.

(d) *Product samples.* When required by the solicitation, product samples shall be submitted at or prior to the time specified for receipt of offers. Unless otherwise specified in this solicitation, these samples shall be

submitted at no expense to the Government, and returned at the sender's request and expense, unless they are destroyed during preaward testing.

(e) *Multiple offers.* Offerors are encouraged to submit multiple offers presenting alternative terms and conditions or commercial items for satisfying the requirements of this solicitation. Each offer submitted will be evaluated separately.

(f) *Late submissions, modifications, revisions, and withdrawals of offers.*
(1) Offerors are responsible for submitting offers, and any modifications, revisions, or withdrawals, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that offers or revisions are due.

(2)(i) Any offer, modification, revision, or withdrawal of an offer received at the Government office designated in the solicitation after the exact time specified for receipt of offers is ``late'' and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(A) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of offers; or

(B) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(C) If this solicitation is a request for proposals, it was the only proposal received.

(ii) However, a late modification of an otherwise successful offer, that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(3) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the offer wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(4) If an emergency or unanticipated event interrupts normal Government processes so that offers cannot be received at the Government office designated for receipt of offers by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of offers will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(5) Offers may be withdrawn by written notice received at any time

before the exact time set for receipt of offers. Oral offers in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile offers, offers may be withdrawn via facsimile received at any time before the exact time set for receipt of offers, subject to the conditions specified in the solicitation concerning facsimile offers. An offer may be withdrawn in person by an offeror or its authorized representative if, before the exact time set for receipt of offers, the identity of the person requesting withdrawal is established and the person signs a receipt for the offer.

(g) *Contract award (not applicable to Invitation for Bids)*. The Government intends to evaluate offers and award a contract without discussions with offerors. Therefore, the offeror's initial offer should contain the offeror's best terms from a price and technical standpoint. However, the Government reserves the right to conduct discussions if later determined by the Contracting Officer to be necessary. The Government may reject any or all offers if such action is in the public interest; accept other than the lowest offer; and waive informalities and minor irregularities in offers received.

(h) *Multiple awards*. The Government may accept any item or group of items of an offer, unless the offeror qualifies the offer by specific limitations. Unless otherwise provided in the Schedule, offers may not be submitted for quantities less than those specified. The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit prices offered, unless the offeror specifies otherwise in the offer.

(i) Availability of requirements documents cited in the solicitation.
(1)(i) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29, and copies of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained for a fee by submitting a request to--

GSA Federal Supply Service Specifications Section,
Suite 8100,
470 East L'Enfant Plaza, SW, Washington, DC 20407,
Telephone (202) 619-8925,
Facsimile (202) 619-8978.

(ii) If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (i)(1)(i) of this provision. Additional copies will be issued for a fee.

(2) The DoD Index of Specifications and Standards (DoDISS) and documents listed in it may be obtained from the--

Department of Defense Single Stock Point (DoDSSP),
Building 4, Section D,
700 Robbins Avenue,
Philadelphia, PA 19111-5094,
Telephone (215) 697- 2667/2179,
Facsimile (215) 697-1462.

(i) Automatic distribution may be obtained on a subscription basis.

(ii) Order forms, pricing information, and customer support information may be obtained--

(A) By telephone at (215) 697-2667/2179; or

(B) Through the DoDSSP Internet site at <http://assist.daps.mil>.

(3) Nongovernment (voluntary) standards must be obtained from the organization responsible for their preparation, publication, or maintenance.

(j) Data Universal Numbering System (DUNS) Number. (Applies to offers exceeding \$25,000.) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation ``DUNS'' followed by the DUNS number that identifies the offeror's name and address. If the offeror does not have a DUNS number, it should contact Dun and Bradstreet to obtain one at no charge. An offeror within the United States may call 1-800-333-0505. The offeror may obtain more information regarding the DUNS number, including locations of local Dun and Bradstreet Information Services offices for offerors located outside the United States, from the Internet home page at <http://www.customerservice@dnb.com>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

4. EVALUATION -- COMMERCIAL ITEMS (FAR 52.212-2) (JAN 1999)

(a) The Government will award a contract resulting from this solicitation to the responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, price and other factors considered. The following factors shall be used to evaluate offers:

SEE ATTACHED TECHNICAL EVALUATION CRITERIA

Technical and past performance, when combined, are **significantly more important than price.**

(b) *Options.* The Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. The Government may determine that an offer is unacceptable if the option prices are significantly unbalanced. Evaluation of options shall not obligate the Government to exercise the option(s).

(c) A written notice of award or acceptance of an offer, mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer, shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award.

5. OFFEROR REPRESENTATIONS AND CERTIFICATIONS -- COMMERCIAL ITEMS (FAR 52.212-3) (JUL 2002)

(a) *Definitions.* As used in this provision:

"Emerging small business" means a small business concern whose size is no greater than 50 percent of the numerical size standard for the NAICS code designated.

"Forced or indentured child labor" means all work or service-

(1) Exacted from any person under the age of 18 under the menace of any penalty for its nonperformance and for which the worker does not offer himself voluntarily; or

(2) Performed by any person under the age of 18 pursuant to a contract the enforcement of which can be accomplished by process of penalties.

"Service-disabled veteran-owned small business concern"-

(1) Means a small business concern-

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern" means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and size standards in this solicitation.

"Veteran-owned small business concern" means a small business concern-

(1) Not less than 51 percent of which is owned by one or more veterans(as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned business concern" means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the its stock is owned by one or more women; and whose management and daily business operations are controlled by one or

more women.

"Women-owned small business concern" means a small business concern --

(1) That is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(b) *Taxpayer identification number (TIN)* (26 U.S.C. 6109, 31 U.S.C. 7701). (Not applicable if the offeror is required to provide this information to a central contractor registration database to be eligible for award.)

(1) All offerors must submit the information required in paragraphs (b)(3) through (b)(5) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the Internal Revenue Service (IRS).

(2) The TIN may be used by the government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.]

(3) Taxpayer Identification Number (TIN).

[] TIN:_____.

[] TIN has been applied for.

[] TIN is not required because:

[] Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

[] Offeror is an agency or instrumentality of a foreign government;

[] Offeror is an agency or instrumentality of the Federal Government;

(4) Type of organization.

[] Sole proprietorship;

[] Partnership;

[] Corporate entity (not tax-exempt);

[] Corporate entity (tax-exempt);

- ☐ Government entity (Federal, State, or local);
- ☐ Foreign government;
- ☐ International organization per 26 CFR 1.6049-4;
- ☐ Other _____.

(5) Common parent.

- ☐ Offeror is not owned or controlled by a common parent:
- ☐ Name and TIN of common parent:

Name _____

TIN _____

(c) Offerors must complete the following representations when the resulting contract is to be performed inside the United States, its territories or possessions, Puerto Rico, the Trust Territory of the Pacific Islands, or the District of Columbia. Check all that apply.

(1) *Small business concern.* The offeror represents as part of its offer that it ☐ is, ☐ is not a small business concern.

(2) *Veteran-owned small business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents as part of its offer that it ☐ is, ☐ is not a veteran-owned small business concern.

(3) *Service-disabled veteran-owned small business concern. [Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (c)(2) of this provision.]* The offeror represents as part of its offer that it ☐ is, ☐ is not a service-disabled veteran-owned small business concern.

(4) *Small disadvantaged business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents, for general statistical purposes, that it ☐ is, ☐ is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(5) *Women-owned small business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents that it ☐ is, ☐ is not a women-owned small business concern.

Note: Complete paragraphs (c)(6) and (c)(7) only if this solicitation is expected to exceed the simplified acquisition threshold.

(6) *Women-owned business concern (other than small business concern). [Complete only if the offeror is a women-owned business concern and did not represent itself as a small business concern in paragraph (c)(1) of this provision.].* The offeror represents that it ☐ is, a women-owned business

concern.

(7) *Tie bid priority for labor surplus area concerns.* If this is an invitation for bid, small business offerors may identify the labor surplus areas in which costs to be incurred on account of manufacturing or production (by offeror or first-tier subcontractors) amount to more than 50 percent of the contract price:

(8) Small Business Size for the Small Business Competitiveness Demonstration Program and for the Targeted Industry Categories under the Small Business Competitiveness Demonstration Program. *[Complete only if the offeror has represented itself to be a small business concern under the size standards for this solicitation.]*

(i) *[Complete only for solicitations indicated in an addendum as being set-aside for emerging small businesses in one of the four designated industry groups (DIGs).]* The offeror represents as part of its offer that it [] is, [] is not an emerging small business.

(ii) *[Complete only for solicitations indicated in an addendum as being for one of the targeted industry categories (TICs) or four designated industry groups (DIGs).]* Offeror represents as follows:

(A) Offeror's number of employees for the past 12 months (check the Employees column if size standard stated in the solicitation is expressed in terms of number of employees); or

(B) Offeror's average annual gross revenue for the last 3 fiscal years (check the Average Annual Gross Number of Revenues column if size standard stated in the solicitation is expressed in terms of annual receipts).

(Check one of the following):

Number of Employees	Average Annual Gross Revenues
<input type="checkbox"/> 50 or fewer	<input type="checkbox"/> \$1 million or less
<input type="checkbox"/> 51-100	<input type="checkbox"/> \$1,000,001-\$2 million
<input type="checkbox"/> 101-250	<input type="checkbox"/> \$2,000,001-\$3.5 million
<input type="checkbox"/> 251-500	<input type="checkbox"/> \$3,500,001-\$5 million
<input type="checkbox"/> 501-750	<input type="checkbox"/> \$5,000,001-\$10 million
<input type="checkbox"/> 751-1,000	<input type="checkbox"/> \$10,000,001-\$17 million
<input type="checkbox"/> Over 1,000	<input type="checkbox"/> Over \$17 million

(9) *[Complete only if the solicitation contains the clause at FAR 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns, or FAR 52.219-25, Small Disadvantaged Business Participation Program-Disadvantaged Status and Reporting, and the offeror desires a benefit based on its disadvantaged status.]*

(i) *General.* The offeror represents that either-

(A) It [] is, [] is not certified by the Small Business Administration as a small disadvantaged business concern and identified, on

the date of this representation, as a certified small disadvantaged business concern in the database maintained by the Small Business Administration (PRO-Net), and that no material change in disadvantaged ownership and control has occurred since its certification, and, where the concern is owned by one or more individuals claiming disadvantaged status, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); or

(B) It [] has, [] has not submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR 124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted.

(ii) [] *Joint Ventures under the Price Evaluation Adjustment for Small Disadvantaged Business Concerns.* The offeror represents, as part of its offer, that it is a joint venture that complies with the requirements in 13 CFR 124.1002(f) and that the representation in paragraph (c)(9)(i) of this provision is accurate for the small disadvantaged business concern that is participating in the joint venture. *[The offeror shall enter the name of the small disadvantaged business concern that is participating in the joint venture: _____.]*

(10) *HUBZone small business concern. [Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.]* The offeror represents, as part of its offer, that--

(i) It [] is, [] is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It [] is, [] is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (c)(10)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. *[The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture: _____.]* Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(d) *Representations required to implement provisions of Executive Order 11246 --*(1) Previous contracts and compliance. The offeror represents that --

(i) It [] has, [] has not, participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation; and

(ii) It [] has, [] has not, filed all required compliance reports.

(2) Affirmative Action Compliance. The offeror represents that --

(i) It []has developed and has on file, []has not developed and does not have on file, at each establishment, affirmative action programs required by rules and regulations of the Secretary of Labor (41 CFR parts 60-1 and 60-2), or

(ii) It []has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

(e) *Certification Regarding Payments to Influence Federal Transactions (31 U.S.C. 1352)*. (Applies only if the contract is expected to exceed \$100,000.) By submission of its offer, the offeror certifies to the best of its knowledge and belief that no Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with the award of any resultant contract.

(f) *Buy American Act Certificate*. (Applies only if the clause at Federal Acquisition Regulation (FAR) 52.225-1, Buy American Act--Supplies, is included in this solicitation.)

(1) The offeror certifies that each end product, except those listed in paragraph (f)(2) of this provision, is a domestic end product (as defined in the clause of this solicitation entitled "Buy American Act--Supplies") and that the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States. The offeror shall list as foreign end products those end products manufactured in the United States that do not qualify as domestic end products.

(2) Foreign End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(3) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25.

(g)(1) *Buy American Act -- North American Free Trade Agreement -- Israeli Trade Act Certificate*. (Applies only if the clause at FAR 52.225-3, Buy American Act - North American Free Trade Agreement Israeli Trade Act, is included in this solicitation.)

(i) The offeror certifies that each end product, except those listed in paragraph (g)(1)(ii) or (g)(1)(iii) of this provision, is a domestic end product as defined in the clause of this solicitation entitled "Buy American Act -- North American Free Trade Agreement -- Israeli Trade Act" and that the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States.

(ii) The offeror certifies that the following supplies are NAFTA country end products or Israeli end products as defined in the clause of this solicitation entitled "Buy American Act-North American Free Trade Agreement-Israeli Trade Act":

NAFTA Country or Israeli End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(iii) The offeror shall list those supplies that are foreign end products (other than those listed in paragraph (g)(1)(ii) or this provision) as defined in the clause of this solicitation entitled "Buy American Act-North American Free Trade Agreement-Israeli Trade Act." The offeror shall list as other foreign end products those end products manufactured in the United States that do not qualify as domestic end products.

Other Foreign End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(iv) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25.

(2) *Buy American Act--North American Free Trade Agreements--Israeli Trade Act Certificate, Alternate I (May 2002)*. If Alternate I to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Canadian end products as defined in the clause of this solicitation entitled ``Buy American Act--North American Free Trade Agreement--Israeli Trade Act':

Canadian End Products:

Line Item No.

(List as necessary)

(3) Buy American Act--North American Free Trade Agreements--Israeli Trade Act Certificate, Alternate II (May 2002). If Alternate II to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Canadian end products or Israeli end products as defined in the clause of this solicitation entitled ``Buy American Act--North American Free Trade Agreement-Israeli Trade Act'':

Canadian or Israeli End Products:

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(4) *Trade Agreements Certificate*. (Applies only if the clause at FAR 52.225-5, Trade Agreements, is included in this solicitation.)

(i) The offeror certifies that each end product, except those listed in paragraph (g)(4)(ii) of this provision, is a U.S.-made, designated country, Caribbean Basin country, or NAFTA country end product, as defined in the clause of this solicitation entitled "Trade Agreements."

(ii) The offeror shall list as other end products those end products that are not U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products.

Other End Products

LINE ITEM NO.	COUNTRY OF ORIGIN
_____	_____
_____	_____
_____	_____

[List as necessary]

(iii) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25. For line items subject to the Trade Agreements Act, the Government will evaluate offers of U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products without regard to the restrictions of the Buy American Act. The Government will consider for award only offers of U.S.-made, designated country, Caribbean Basin country, or NAFTA country end products unless the Contracting Officer determines that there are no offers for such products or that the offers for such products are

insufficient to fulfill the requirements of the solicitation.

(h) *Certification Regarding Debarment, Suspension or Ineligibility for Award (Executive Order 12549).* (Applies only if the contract value is expected to exceed the simplified acquisition threshold.) The offeror certifies, to the best of its knowledge and belief, that the offeror and/or any of its principals--

(1) ☐ Are, ☐ are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency; and

(2) ☐ Have, ☐ have not, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a Federal, state or local government contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(3) ☐ Are, ☐ are not presently indicted for, or otherwise criminally or civilly charged by a Government entity with, commission of any of these offenses.

(i) *Certification Regarding Knowledge of Child Labor for Listed End Products (Executive Order 13126).* [The Contracting Officer must list in paragraph (i)(1) any end products being acquired under this solicitation that are included in the List of Products Requiring Contractor Certification as to Forced or Indentured Child Labor, unless excluded at 22.1503(b).]

(1) *Listed End Product*

Listed End Product	Listed Countries of Origin:
_____	_____
_____	_____

(2) *Certification.* [If the Contracting Officer has identified end products and countries of origin in paragraph (i)(1) of this provision, then the offeror must certify to either (i)(2)(i) or (i)(2)(ii) by checking the appropriate block.]

☐ (i) The offeror will not supply any end product listed in paragraph (i)(1) of this provision that was mined, produced, or manufactured in the corresponding country as listed for that product.

☐ (ii) The offeror may supply an end product listed in paragraph (i)(1) of this provision that was mined, produced, or manufactured in the corresponding country as listed for that product. The offeror certifies that it has made a good faith effort to determine whether forced or indentured child labor was used to mine, produce, or manufacture any such end product furnished under this contract. On the basis of those efforts, the offeror certifies that it is not aware of any such use of child labor.

ATTACHMENT 1

ADDENDUM TO FAR CLAUSE 52.212-4

1. EVALUATION OF OPTIONS (FAR 52.217-5) (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirements. Evaluation of options will not obligate the Government to exercise the option(s).

2. PERIOD OF PERFORMANCE (EP 52.212-140) (APR 1984)

The period of performance of this contract shall be from Award Date through 360 Days After Award inclusive of all required reports.

3. TECHNICAL QUESTIONS (EP 52.215-110) (APR 1984)

Offerors must submit all technical questions concerning this solicitation in writing to the contract specialist. EPA must receive the questions no later than 10 calendar days after the date of this solicitation. EPA will answer questions which may affect offers in an amendment to the solicitation. EPA will not reference the source of the questions.

4. OPTION FOR INCREASED QUANTITY--FIXED-PRICE CONTRACT (EP 52.217-982) (APR 1984)

(a) The Government may increase the quantity of work called for under this contract as follows:

Optional Items	Qty	Unit	Unit Price	Delivery Date
0002. Engine Test Cell Controller and Data Acquisition System Similar to Test Cell 2 with Safety System, Engine Throttle Controller/Positioner, and Test Cell Instrument Boom in accordance with the attached Statement of Work.	1	Each	\$ _____	TBD
0003. Combustion Analysis System for Each System in accordance with the attached Statement of Work.	MAX 3	Each	\$ _____	TBD
0004. One (1) Year Extended Warranty for Each System in accordance with the attached Statement of Work.	MAX 3	Each	\$ _____	TBD
0005. Two (2) Year Extended Warranty for Each System in accordance with the attached Statement of Work.	MAX 3	Each	\$ _____	TBD

(b) The Contracting Officer may exercise an option by written notice to the Contractor within the following time periods:

Optional Items	Time Period for Exercising Option
0002	Up to Ninety (90) Days After Base Contract Completion
0003	Up to Ninety (90) Days After Base Contract Completion
0004	Up to Ninety (90) Days After Base Contract Completion
0005	Up to Ninety (90) Days After Base Contract Completion

5. CONTRACT ADMINISTRATION REPRESENTATIVES (EP 52.242-100) (AUG 1984)

Project Officer(s) for this contract:

Project Officer:

TO BE IDENTIFIED AT TIME OF CONTRACT AWARD

Contract Specialist(s) responsible for administering this contract:

Administrative Contracting Officer:

TO BE IDENTIFIED AT TIME OF CONTRACT AWARD

6. SITE VISIT ARRANGEMENTS AND AVAILABILITY (GSA T024) (JUL 1994)

Offerors are encouraged to inspect Government facilities that may be used for placement of equipment.

A site visit will be held on July 1, 2003 at 1:00 p.m. The site visit will be held at the following location:

U.S. EPA NVFEL
2565 Plymouth Road
Ann Arbor, MI 48105

All arrangements to inspect these facilities must be made in writing no later than 1:00 p.m. Local Time, June 30, 2003. Attendees for the site visit should be listed in vendor's request. Arrangements shall be made with:

U.S. EPA Cincinnati Procurement Operations Division
Mr. Scott Tharp
(513) 487-2092 Telephone
(513) 487-2107 Fax
Tharp.Scott@epa.gov

ATTACHMENT 2

STATEMENT OF WORK

Statement of Work

Test Cell Controllers and Engine Dynamometers for EPA/NVFEL

*Requirements, Functional Specifications, Performance Criteria,
and Acceptance Tests*

U. S. Environmental Protection Agency
National Vehicle and Fuels Emissions Laboratory
2565 Plymouth Road
Ann Arbor, Michigan 48105

Table of Contents

1.0	Overview and General Requirements
1.1	References
1.2	Background and Procurement Overview
1.3	General Description of Test Sites and Measurement System Requirements
1.4	Safety, Health and Environmental Provisions
1.5	Quality Provisions
1.6	Operational Efficiency
1.7	Electrical Requirements
1.8	Project Management
2.0	D002 & D004 System Requirements
2..1	Measurement System Layout and Configuration
2..2	Test-Control, Data Acquisition and Processing System (TDAP)
2.3	Dynamometers
2.4	Throttle Controllers/Amplifiers/Servos
2.5	Performance Requirements for Control of Speed and Load for Transient Testing
2.6	Stand Alone Safety System
2.7	Test Cell Instrumentation Interface
3.0	Other Support Equipment
4.0	Documentation Requirements
5.0	Acceptance Test Performance Requirements
6.0	Warranty
7.0	Training
8.0	Option Items
8.1	Option for Equipping a Third Test Cell
8.2	Combustion Analysis Systems
8.3	Option for Warranty Extension

Table of Contents - Continued

Figures

- Figure 1. Test Site System Architecture
- Figure 2. HD Dyno 2 Floorplan
- Figure 3. HD Dyno 4 Floorplan
- Figure 4. Operator's Console
- Figure 5. Second Order Response Characteristics

Appendices

- Appendix A. Abbreviations and Terms
- Appendix B. Description of EPA Test Site Equipment Interface Requirements
- Appendix C. Description of EPA Interface Computer (IFC) and TDAP/IFC Interface Requirements
- Appendix D. General Interface Guidelines
- Appendix E. Pressure Transducer Specifications
- Appendix F. Supplemental Requirements for Time-of-Operation Quality Monitoring
- Appendix G. Supplemental Engine Emission Report Data
- Appendix H. Combustion Analyzer Specification
- Appendix I. Schedule of Deliverables

1.0 Overview and General Requirements

Section 1 provides an overview of the scope of the project and general requirements of the equipment being procured.

Specific references, which provide important technical information or guidance, are listed in Section 1.1. Where noted, the requirements of some documents are incorporated by reference as requirements of this Statement of Work. Background information is presented in Section 1.2.

A general description of the equipment covered by this Statement of Work, and associated requirements, is presented in Section 1.3. Other general requirements are covered in the balance of Section 1, including requirements for project management.

Contract deliverables and specific requirements are addressed in detail in subsequent sections of the Statement of Work.

Definitions of the acronyms used in this document are shown in the Appendix A.

Proposal instructions are found in Attachment 3 of the Request for Proposal. Following these instructions carefully, and considering the Technical Evaluation Criteria presented in Attachment 4, are critical steps to preparing a responsive proposal.

1.1 References

- 1.1.1 Code of Federal Regulations 40 CFR Subchapter C, Part 86 “Control of Emissions From New and In-Use Highway Vehicles and Engines,” Subparts B, M, N, R, S
- 1.1.2 EPA non-regulatory non-road duty cycles
<http://www.epa.gov/oms/regs/nonroad/equip-hd/cycles/nrcycles.htm>
<http://www.epa.gov/oms/regs/nonroad/equip-hd/cycles/nrcycles.xls>
 A spreadsheet for denormalizing these cycles is found at:
<http://www.epa.gov/oms/regs/nonroad/equip-hd/cycles/denormlz.xls>
- 1.1.3 Reserved
- 1.1.4 Code of Federal Regulations 29 CFR Part 1910 “Occupational Safety and Health Standards”

All CFR references may be found at <http://www.access.gpo.gov/ecfr/>

1.1.5 ISO DIS 17025 - General Requirements for the Competence of Testing and Calibration Laboratories

(www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=30239)

1.1.6 NFPA 70, National Electrical Code (www.nfpa.org)

1.1.7 EPA Facilities Manual dated February, 1998 - Volume 1 (A/E&Planning Guidelines) and Volume 4 (4844 - Facility Safety, Health and Environmental Management Manual)

All references shall be the most current available as of the date of this solicitation.

1.2 Background and Procurement Overview

1.2.1 As part of the Clean Air Act and its Amendments, a variety of new emissions regulations have been implemented for large on-road and off-road engines. The 2007 Diesel engine rulemaking is an example of testing requiring advanced engine operation and integrated test cell control. The EPA NVFEL has undertaken a comprehensive program to implement new and refined test systems to enhance the capabilities to conduct diverse engine emissions testing, of the highest precision and accuracy, on a broad range of engines.

This document describes the engineering and operational requirements for engine dynamometers and test cell control systems that will be required for implementing these enhanced capabilities. The equipment described in this document shall be installed as integrated systems at NVFEL, in rooms 413/415, known as HD Dyno 2, with the second, nearly identical, system to be installed in rooms 419/421, known as HD Dyno 4. These dynamometers and control systems shall be used to evaluate both regulated emissions and currently unregulated emissions from Diesel engines, operating in a variety of ambient conditions and on a variety of fuels including those currently considered as "alternative". This specification addresses requirements to operate engines to measure emissions at levels lower than current standards.

1.2.2 All general requirements listed in this Statement of Work (SOW) apply to all equipment purchased under this contract.

- 1.2.3 The contractor shall be accountable for supervising any and all subcontractors that it brings to the job site. Further, it is accountable for any damage caused by any of its employees or subcontractors.
- 1.2.4 For the equipment specified, the contractor shall have total system responsibility, which shall include all phases of the project, design/configuration, assembly, integration, quality assurance, delivery to EPA-NVFEL, installation, calibration, commissioning, acceptance testing, documentation and training of EPA staff. The contractor shall be responsible for documenting measurement traceability and system acceptance in a manner suitable for audit to ISO 17025 standards.
- 1.2.5 All equipment and supplies furnished under this contract shall be new at the time of delivery to the NVFEL. Unless otherwise specified, software and equipment provided under this contract shall be of the most current model and type.

1.3 General Description of Test Sites and System Requirements

- 1.3.1 The core requirements of this contract are for two (2) highly flexible engine test cell controller and data acquisition systems, two (2) engine dynamometers, two (2) engine throttle controllers/positioners, two (2) dedicated safety monitoring systems and two (2) test cell instrument booms. One for each of the two separate test cells at EPA. All services to fully integrate this equipment and other existing test cell equipment to provide a highly efficient and effective test system shall be included. Equipment interface requirements are outlined in Appendix B of this Statement of Work. Other support equipment is also required, and described in other parts of this Statement of Work. Other additional equipment and services shall also be offered as options, as outlined below.
- 1.3.2 Heavy Duty Engine Test Site HD Dyno 2 (Figure 2)

This is an existing test site at NVFEL, intended to provide a wide range of test capabilities for heavy duty spark ignited and compression ignited (Diesel) engines. The current dynamometer is an older GE 600 HP DC dynamometer with electrical control

and interface provided through a Dyne Systems Dyne-Loc Digital Dynamometer Controller.

The equipment delivered under this contract shall be fully integrated with existing sample and measurement systems and other equipment to be provided by others. Exhaust sampling for Site D002 will be from a 4,000 to 10,000 SCFM CVS exhaust sampling system, to be provided under separate contract. Emissions measurements are provided by an existing Horiba MEXA 7000LE analysis system. A number of auxiliary sampling systems may be used at any time including, but not limited to, a Horiba PM sampler to control sample flows for gravimetric particulate matter sampling, fuel flow measurement, V&F mass spectrometer, and smoke measurement devices. Provisions shall also be provided to support a future raw exhaust analysis bench in addition to the dilute bench currently in place.

1.3.3 Heavy Duty Engine Test Site HD Dyno 4 (Figure 3)

This site is currently fitted with an older GE 380 HP DC dynamometer, controlled by a Dyne Systems Dyne-Loc controller. Under this contract, this site will be fitted with 600 HP AC flux-vectorized dynamometer. Sampling and analysis systems for HD Dyno 4 have yet to be determined, but similar interfaces to those detailed for HD Dyno 2 shall be required. The contractor shall be responsible for the integration of its equipment with the existing test site measurement equipment. At the time of contract award, EPA may choose an alternate location immediately adjacent to HD Dyno 4. The overall layout of this test cell is identical to HD Dyno 4 except it is a mirror image of that cell.

1.3.4 The provided test cell control systems shall provide for test sequencing and automated control of exhaust sampling and analysis, data acquisition and data analysis, data processing and file transfer, along with a variety of tools for maintenance of calibration and support activities. The contractor shall deliver systems capable calculating and reporting the mass emissions from engines in accordance with the emissions standards and regulations referenced in Section 1.1 and the specifications contained herein.

1.3.5 The contractor shall provide for the removal of the existing dynamometer, HD Dyno 2. Removal shall include all peripheral dynamometer equipment. All dynamometer equipment (dynamometers, power drive equipment, controllers, etc.) removed under this contract shall be carefully disconnected, and the wiring and mechanical connections

marked. Documentation shall be provided to the EPA detailing the function and label of each wire or terminal that is disconnected during the removal. The purpose of this requirement is to facilitate reinstallation of these items at a later date. Removal shall include moving this equipment to a designated on-site storage location.

Options

1.3.6 Option for Additional Test Cell Controller and Data Acquisition System

The contractor shall offer one additional test cell controller and data acquisition system, with dedicated safety system, engine throttle controller/positioner and test cell instrument boom, to be configured in a manner that is equivalent in scope to HD Dyno 2. This system will be installed in a test site at the NVFEL, to be specified by the Government at the time the option is exercised.

1.3.7 Option for Combustion Analysis Systems

The contractor shall offer an option for combustion analysis system for each Test Cell Controller and Data Acquisition System purchased. This system may be either from a third party or manufactured by the contractor and shall be fully integrated with the provided Test Cell Controller and Data Acquisition Systems. Detailed requirements for the combustion analysis system are presented in Section 8.3.

1.4 Safety, Health and Environmental Provisions

- 1.4.1 Providing for a safe working environment is the highest priority in all EPA equipment purchases and installation activity. The contractor shall abide and comply with all building and safety codes specified by OSHA, BOCA, and NFPA wherever they might apply, to create an inherently safe system and work environment.
- 1.4.2 Significant risk factors such as noise, ventilation of toxic gases, heated surfaces, electrical shock, and safety interlocks to prevent accidental errors shall be considered, and control measures to ensure the safety of operations and maintenance personnel shall be implemented wherever feasible.

- 1.4.3 As required by OSHA, all equipment shall be designed to provide for straightforward lockout protection in accordance with OSHA regulations. Written lockout instructions, in hard copy and electronic formats, shall be provided as part of the “as installed” documentation package.
- 1.4.4 Noise or vibration from equipment installed as part of this contract shall not penetrate the building or cause adverse affects on other equipment in the facility. Sound dampening/suppression devices and/or materials shall be installed as needed to limit noise levels to 60db at 10 feet from any devices to be located outside of the test cell, 75db at 10 feet for devices located in the test cells (room 415 & 421). Devices to be located in the control rooms (room 413 & 419) must meet the 60db requirement.
- 1.4.5 The contractor shall consider energy efficiency in all component selection, system design and operational strategies. Energy efficient equipment, such as those with The “Energy Star” designation shall be utilized when possible.
- 1.4.6 The contractor shall minimize, to the extent possible, the generation and release of harmful materials to the environment in all component selection, system design, operational strategies and installation requirements.
- 1.4.7 The contractor shall be responsible for ensuring that its employees and subcontractors attend a mandatory NVFEL safety briefing and follow all NVFEL safety requirements presented, as well as all applicable OSHA/MIOSHA regulations, while working at NVFEL.
- 1.4.8 The contractor shall provide the NVFEL Project Officer with a complete list of chemicals to be utilized during installation and commissioning operations at NVFEL, and their associated Material Safety Data Sheets (MSDS), at least four weeks prior to system installation.
- 1.4.9 All specifications in Section 1.4 shall apply to all items delivered under this contract, including both required items and options.

1.5 Quality Provisions

- 1.5.1 EPA is seeking to purchase test systems that will produce data of highest precision and accuracy with a high level of certainty, in a manner that can be comprehensively demonstrated and documented. All equipment and all functions delivered under this contract must integrate with the sampling and analytical systems, and be in accordance with the engine emissions testing of the Code of Federal Regulations, and all other codes, standards, practices, etc. included by reference therein or elsewhere in this document.

Further, the test systems must support a range of development tests for which no current standards exist. Testing of this type must conform to accepted laboratory practices.

- 1.5.2 The contractor shall be expected to carefully consider all requirements referenced in this Statement of Work, and all other documents incorporated by reference, and design a complete and efficient quality strategy for ensuring that all systems delivered as part of this contract meet those requirements, and will continue to meet them on an on-going basis. This strategy is expected to include automated pre-test and post-test checks, diagnostic checks, real-time condition monitoring and exception reporting, routine maintenance activities, mistake-proofing and full documentation of NIST traceability where applicable, including original certificates of calibration. Examples of items requiring NIST traceability under this requirement include, but are not limited to, dynamometer calibration weights, calibration arm length, computer time bases, and voltages from power supplies.
- 1.5.3 All documentation and system instructional, alarm and warning messages shall be delivered in a clear, concise manner, in plain English, with a minimum of technical jargon.
- 1.5.4 Systems delivered under this contract are expected to support compliance with ISO 9000 series standards, and ISO DIS 17025, in a complete and efficient manner.
- 1.5.5 The contractor shall provide automated systems which monitor and track long term performance of key instrument operating parameter such as response, flow, temperature drift, etc., to provide early warning of failure or significant change in operating performance. In some cases, this may be accomplished by monitoring the internal system imbedded in auxiliary equipment (for example, the Horiba MEXA analyzer) and reporting any difficulties.
- 1.5.6 The contractor shall deliver systems which provide for automated archiving of active, as well as previous or inactive, calibration and verification data for all interfaced instrumentation.

1.5.7 The contractor shall provide systems for the automated verification and calibration of all provided test instrumentation.

1.5.8 Reserved

1.5.9 Within the context of this Statement of Work the word “calibration” shall mean:

Calibration - set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or reference material, and the corresponding values realized by standards. (International Vocabulary of Basic and General Terms in Metrology (VIM; 1993) definition)

Furthermore “calibration” shall mean a defined set of actions which produce a permanent record of the relation of instrument response to standards.

Calibration shall not refer to the routine adjustment of instrument offset and gain through the use of “zero and span” materials.

1.5.10 The delivered systems shall not update any calibration data or other constants that affect emission results without first explicitly verifying via a dialog box that the action should occur. If the update is affirmed, the update shall be implemented immediately without having to reload any portion of the system or take other further action of any kind. The system shall include electronic storage of easily accessible, and printable calibration records.

The calibration update verification dialog box shall prompt for an operator ID and provide for operator comments, if any. These updates shall be permanently and centrally documented in an electronic file which stores the old information and new information as part of a clear audit trail. The update documentation file shall be readily accessible, printable, achievable, and copyable, and shall provide for additional comments, which may be added at any time at the restricted “maintenance” level of password protection. Password protection requirements are further defined in Section 2.2.20.

This update function shall be available both “real-time,” such as immediately following a calibration procedure, or at a later time, and shall include the option for additional control through the use of a special entry code. Activation of the access code option shall only restrict actual change implementation. Changes may be stored as “pending” for later implementation. All pending changes shall be easily retrievable for later authorization via a screen-viewable and printable listing. Only one calibration for any device and range shall be allowed to be “pending” at one time.

At a minimum, each record in the documentation file shall include a unique serial number, a clear description of the action taken, with change time and date, the resulting data change, operator ID, comments, and verification code (if any). Upon finalization of any given calibration, the system shall assign a unique identifier so that all tests run under any given set of calibrations can be linked to the calibrations that were active at the time of testing.

- 1.5.11 All specifications in Section 1.5 shall apply to all items delivered under this contract, including both required items and options.

1.6 Operational Efficiency

- 1.6.1 The EPA seeks to maximize value in all its testing operations, and expects the measurement systems delivered as part of this contract to demonstrate a high level of efficiency. The contractor shall consider operational efficiency in all aspects of the design and functioning of the contracted systems. As a simple example, during an automated protocol for CVS verification, it is expected that the system would automatically zero and span the hydrocarbon analyzer while simultaneously acquiring samples, thus internalizing one operation to another and minimizing the total time required for the entire operation.
- 1.6.2 The equipment shall be designed and configured to function satisfactorily for extended periods on a continuous basis, except for scheduled maintenance. Scheduled maintenance shall be minimized.
- 1.6.3 The system shall be designed and configured to facilitate safe, one-person test operation.
- 1.6.4 All components of the systems specified in this contract must be free of any date-based obsolescence (e.g. "Y2K") problem that would impair operational efficiency or veracity through the year 2050.
- 1.6.5 All specifications in Section 1.6 shall apply to all items delivered under this contract, including both required items and options.

1.7 Electrical Requirements

1.7.1 Reserved

1.7.2 Electrical power shall be provided by EPA to within 50 feet of the point of use.

The EPA will provide the following 3 types of power panels, as required, within 50 feet of the point of use. Motor and other noisy loads will not be allowed on the clean power grid.

208V/120V, 1 phase, 60 Hz, utility grade power

480V/277V, 3 phase, 60 Hz, utility grade power

208V/120V, 1 phase, 60 Hz, clean power

1.7.3 All equipment shall be installed in accordance with the most current edition of NFPA 70, National Electrical Code and required local codes.

1.7.4 Equipment design and installation shall permit operation in compliance with Occupational Safety & Health Administration (OSHA) Standards Part Number 1910. Electrical equipment shall comply with Part 1910 Subpart S.

1.7.5 Equipment design and installation shall be in compliance with the most current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.7.6 Equipment design and installation shall provide energy-isolating devices required for equipment operators to follow the OSHA rule on the Control of Hazardous Energy (Lockout/Tagout) of Title 29 of the Code of Federal Regulations (29 CFR) Part 1910.147.

1.7.7 All electrical cables shall be isolated from gas lines or other piping containing flammable products.

1.7.8 The contractor is responsible for providing and installation of all power circuit disconnects, transformers, circuit protection devices, and associated hardware required to interface with EPA provided power panels of paragraph 1.7.2.

1.7.9 All power receptacles shall be heavy duty, industrial grade. Spare power receptacles for future upgrades and maintenance shall be provided.

- 1.7.10 Clean/uninterruptible power outlets shall be clearly marked and in a color selected by the project officer.
- 1.7.11 Clean/uninterruptible power outlets shall be isolated from utility grade power systems and installed in accordance with the principles of IEEE Std 1100.
- 1.7.12 All cables external to equipment cabinets with voltages over 50V (AC or DC) shall be run in metal conduit or other EPA approved raceway.
- 1.7.13 Control and signal cables shall be isolated from power cables. All signal cabling shall not be adversely affected due to capacitive or inductive interference.
- 1.7.14 All Control and signal cables/wires shall be permanently labeled with to/from and signal/function name information that corresponds with the provided electrical schematic.
- 1.7.15 All crimp or compression type connections shall use only the component manufacturer's approved crimp tools and shall follow the component manufacturer's termination instructions.
- 1.7.16 Discrete digital input/output (I/O) channels shall be 0 to 5 volt TTL level and shall be optically isolated from their source.
- 1.7.17 Digital I/O communications channels shall conform to recognized industry standards such as IEEE 802, RS232, RS485, IEEE 488, IEEE 1394, or USB.
- 1.7.18 Analog I/O shall support ± 5 VDC, ± 10 VDC and thermocouple inputs, with appropriate signal conditioning and isolation.
- 1.7.19 The contractor shall provide complete electrical schematics and wire lists in its final documentation package.
- 1.7.20 All specifications in Section 1.7 shall apply to all items delivered under this contract, including both required items and options.

1.8 Project Management and Schedule of Deliverables

- 1.8.1 The contractor shall comprehensively manage the project to ensure on-time completion and efficient interaction with EPA during all phases of the project. The contractor shall develop a preliminary project plan for review with EPA at a project kick off meeting. The Project Management plan shall indicate the contractor's project manager, key personnel and contact information, the project time line, and sample formats for meeting minutes, progress reports and open issue tracking. Based on the outcome of the Project Kickoff meeting, the contractor shall deliver a complete project management plan as indicated on the Schedule of Deliverables for this contract, presented in Appendix I.
- 1.8.2 The project management plan should also include the submissions, milestones and events to be completed no later than the dates indicated on the Schedule of Deliverables. Alternate dates for intermediate milestones may be proposed at the Project Kickoff meeting, but all modifications must be approved by the EPA Contracting Officer.
- 1.8.3 System acceptability shall be demonstrated during the off-site acceptance process. Equipment shipment to EPA shall not occur until this requirement is met. The contractor shall have responsibility for preparing a report thoroughly documenting all quality assurance activities and acceptance results. The Project Officer shall have the right to witness any or all acceptance tests.
- 1.8.4 The contractor shall provide on-site supervision of all installation, commissioning and acceptance activities. All contractor personnel who will be working on-site at NVFEL shall receive 1-hour briefing by EPA personnel on specific safety and security issues. All contractor personnel and subcontractor personnel must comply with EPA/NVFEL safety and security measures while working at NVFEL.
- 1.8.5 All specifications in Section 1.8 shall apply to all items delivered under this contract, including both required items and options.

2.0 HD Dyno 2 and HD Dyno 4 Equipment Requirements

2.1 Measurement System Layout and Configuration

- 2.1.1 The contractor shall design a layout for the delivered systems that optimally fulfills the various requirements of this Statement of Work, based on the nominal test site layout shown in Figures 2 and 3, and further information to be gained through site visits and site surveys conducted during the design phase of this contract.

2.2 Test-Control, Data Acquisition and Processing Systems (TDAP)

- 2.2.1 These systems of computers, logic controllers, displays and associated devices shall integrate and control the operation of a test engine in both transient and steady state test modes. Further, these systems shall initiate and terminate operation of the sampling and analytical systems and collect all data related to processing an emissions test. They shall provide a clear, simple and logical user interface. They shall perform associated quality control of the testing process and provide rigorous documentation associated with quality control and traceability. They shall provide automation of most tasks associated with testing and support activities, such as equipment calibration functions. They shall provide for preliminary processing, reporting and file transfer of test data, and provide a range of flexible data analysis tools to support special investigations and trouble shooting. The systems shall integrate with the EPA/NVFEL-provided test site equipment, described in Appendix B.

The system shall utilize a dedicated real-time processor to command and control dynamometer and engine operating systems and to accumulate test data (emissions, temperatures, pressures, analog and digital signals, etc). The real-time processor must utilize a true real-time operating system. A separate processor shall be provided as part of this system to facilitate the operator interface, and shall utilize a standard PC operating system, Windows 2000 Professional Operating System, or higher. Additional components may be utilized to provide other functions specified herein: for example, a specific system may be used to facilitate data acquisition. The acronym "TDAP" refers to the system comprised by these two computers, as well as any additional equipment used to provide these functions. Any contractor-supplied computer systems shall be modular and expandable, yielding systems that support future upgrades and modifications.

- 2.2.2 The contractor shall integrate each TDAP with a separate EPA-supplied network interface computer (IFC), described in Appendix C. The TDAP-IFC integration shall provide a direct and controlled communication link between the test system and the EPA/NVFEL Laboratory Network System (LNS) via a network switch. A block diagram showing the desired test site / LNS architecture may be found in Figure 1.

The purpose of the IFC is to provide a uniform, controlled and restricted interface between laboratory instrumentation and the Laboratory Network System. The use of IFCs at NVFEL allows for isolation of instrumentation from other extraneous laboratory and network activity. The IFC shall function only to provide for the passing of files between the test site system (TDAP) and LNS, as well as other LNS-based operations to be determined and defined by EPA.

- 2.2.3 TDAP may consist of a range of hardware and software components depending on the configuration and functioning of the contractor's systems, provided the automation requirements contained in this Statement of Work are met. The TDAP shall utilize an "open design", which allows the user to access the system for future user-defined configuration modifications.
- 2.2.4 TDAP computer systems shall utilize color and real-time graphics and shall provide for multiple window operating systems.
- 2.2.5 All TDAP operating system software, control software and parameters, and data acquisition interfaces shall be stored and accessed using the most up to date commercially available standard microcomputer hardware and "Commercial Off the Shelf" (COTS) components where possible. A minimum of 2 ea. 18" diagonal, or larger LCD flat panel monitors shall be provided and used for standard displays for each system delivered. In typical use, one display shall show a grouping of standard run-time parameters, and the second display shall be used to display special interest parameters.
- 2.2.6 The computer interfaces shall be designed such that personnel without special computer experience will be able to operate the control system and the peripheral units, including the input of parameter changes, and reconfiguration displays, limit tables, and test sequences, with minimal basic system training. This training shall be provided as part of this contract, as specified in Section 7.0.

- 2.2.7 The test process control software shall utilize a graphical user interface and provide for user definition, customization and modification of variables, limit tables, alarm functions and test process scripts. Variables shall be definable as Boolean, integer, or floating point, with at least 6 significant digits stored plus the exponent ($\pm x.xxxxxE\pm nn$). All variables (system and user defined) and their associated definitions and settings shall be viewable on screen and printable as a list showing the variable descriptive information. At a minimum, variable lists shall be presented in alphabetic order, or be readily sortable. See Appendix C for general file transfer and interfacing requirements.
- 2.2.8 The system shall support the definition of calculated variables that are derived from combinations of other user-defined variables. These variables shall be usable in all scripts without redefinition.
- 2.2.9 The system shall utilize a script-type command automation structure. Hence, global updates to all scripts are made by changing the parameters of the variable definition in one location rather than in every script.
- 2.2.10 The system shall provide for automated context and syntax checking of user-defined scripts and alterations. Diagnostic error messages and help comments shall be provided to the user. All scripts shall be viewable and printable.
- 2.2.11 Any window on any TDAP display screen shall be printable to the system laser printer and shall be automatically scaled to fit the page.

The current date and time, in any format that contains month, day, year, hour, minute, and second, shall be contained on all printed images of screens, files, or reports from the system. The system name and software version from which the output was generated shall also be contained on the printout.

- 2.2.12 TDAP shall provide for all data acquisition required for all functions related to the performance of this Statement of Work including:
- a) All pressures required for calculations and for operational monitoring and quality control
 - b) All temperatures required for calculations and for operational monitoring and quality control
 - c) All flow rates required for calculations and for operational monitoring and quality control

- d) All concentrations required for calculations and for operational monitoring and quality control
 - e) Test cell humidity and barometric pressure
 - f) All digital (on/off) or frequency data required for process control, operational monitoring and quality control
 - g) Engine Speed Optical Tachometer
 - h) Instantaneous fuel consumption (user configurable scaling and units)
 - i) Torque meter signals (case and in-line)
 - j) All other instrumentation required to support the instrumentation boom described in Section 2.7, other existing and planned test equipment specified in this SOW, and other interconnections required by the contractor's specific designs
 - k) Minimum 32 Spare Channels (± 10 VDC input - user configurable scaling and units)
 - l) Minimum 16 Spare Channels (Frequency 100KHz - user configurable scaling and units)
 - m) Minimum 32 Spare Channels (Temperature degrees Centigrade, J-type thermocouple)
 - n) Minimum 32 Spare Channels (Temperature degrees Centigrade, K-type thermocouple)
 - o) Minimum 16 spare digital input channels
 - p) Minimum 16 spare digital output channels
- 2.2.13 A minimum of 10 closed loop, self-tuning control channels shall be provided for the control of Government-supplied peripheral equipment such as control valves, heaters, etc. Eight of these shall be able to operate at 10 HZ, with the remainder able to run at up to 100 HZ. Actual sample rates shall be user-selectable. Proportional Integral Derivative (PID) controllers, or equivalent, will satisfy this requirement, but must be self-tuning.
- 2.2.14 To facilitate access and reconfiguration of system I/O, a channel definition utility shall be provided.
- 2.2.15 The contractor shall be responsible for the integration of other equipment provided by others with TDAP. Further equipment requiring interface includes but is not limited to the CVS, particulate matter (PM) sampling system, both dilute and raw exhaust gas analysis systems, the fuel measurement and temperature control system, engine cooling water system, and the charge air cooling system. Further details are contained in Appendix B.

- 2.2.16 The TDAP system shall be expandable to at least 256 channels for each system. These expansions shall be accomplished within the provided chassis through the addition of circuit boards or similar simple hardware changes.
- 2.2.17 Minimally, data shall be acquired at 10 Hz. A minimum of 10 channels per test bed shall acquire data at up to 100 Hz. All data shall be stored and made available at the rate at which it is acquired.
- 2.2.18 TDAP shall also include hardware and implemented procedures for the following functions:
- a) Complete system backup & restore from DVD-RAM.
 - b) System configuration, parameters backup & restore.
 - c) Test Data backup & restore.
 - d) File trimming based on creation date or modification date.
 - e) Complete power-down and power-up procedure sequence.
- 2.2.19 TDAP shall include a color laser printer:
- HP LaserJet 5500DN (Duplex and network) or
HP LaserJet 8550DN (Duplex and network)
- Or current equivalent model
- 2.2.20 All access to TDAP shall be password protected as follows, or by a similar design:
- Level 0 (Base Maintenance) - Routine system maintenance functions only, to include automated backup and file trimming procedures.
 - Level 1 (Operator) - The ability to run defined tests, view active channel displays, read (but not change) test scripts, definitions, variable names and other related files, view and print reports, and use interactive functions for analyzing data.
 - Level 2 (Maintenance/Repair) - All level 1 plus the ability to perform diagnostic tests, and perform routine maintenance and trouble shooting functions.
 - Level 3 (Administrative/Engineering) - Full system access. All level 2 plus the ability to edit test scripts, channel configurations, bit maps, tables, user-defined variables, alarm actions, report definitions, and system configuration, and other administrative functions.

TDAP shall include a selectable option, configurable at Level 3, to automatically log out after a predefined duration of system inactivity.

- 2.2.21 The TDAP shall facilitate future upgrades to support the SAE J1939 CAN communication protocol. Support for a protocol converter provides one way to meet this requirement.
- 2.2.22 The TDAP shall serve as the master test sequencer for all engine operation and test cell events when the system is in automatic mode.

TDAP shall interface with and control sample and analysis systems. TDAP shall allow selecting/deselecting specific analyzers and selecting specific measurement ranges at time of use. TDAP shall interface with the sampling system to terminate operation of sample pumps or other sample-specific hardware at the end of a sample event.

TDAP shall interface with the sampling systems to institute leak check procedures. Institution of the leak check shall be configurable to either be automatically performed at the beginning of a test process or manually actuated from the keyboard.

- 2.2.23 At a minimum, TDAP shall provide the following additional implemented, automated processes. For each process TDAP shall provide for all relevant operator interface, data acquisition, data storage and reporting, and operational quality control.

During the design/configuration phase of the project the contractor shall work interactively with EPA to develop detailed specifications for the configuration and implementation of these processes, subject to final approval by EPA as shown on the attached Schedule of Deliverables.

- a) Federal Transient Test Procedures for gasoline-fueled (spark-ignition) and Diesel fueled (compression-ignition) engines, per 40CFR, Part 86, Subpart N.
- b) Federal Test Procedure for Diesel smoke testing, as required in 40CFR, Part 86, Subpart I.
- c) Maximum Applied Power (MAP) testing, used to determine maximum engine output at any given speed, as detailed in 40CFR , Part 86, Subpart N.

- d) A variety of transient (including Non-Road) test cycles shall be contractor programmed. These shall include the cycles appearing in CFR 1039 Appendices I and II. Additional information is available on www.epa.gov/oms/regs/nonroad/equip-hd/cycles/nrcycles/htm.
- e) Steady State (SS) test functions. This shall include pre-programmed tests such as the European 13-Mode test, as well as the ability to select a given mode (manually or from the keyboard) and allow the operator to initiate samples. Test cycles may be found at www.dieselnet.com.
- f) A variety of user-programmed transient and steady-state tests. Transient test capability shall accommodate test cycles lasting up to at least 3 hours.
- g) Cycle tuning and validation functions. All transient test cycles must meet the statistical tests for validity, as detailed in 40CFR86.1341-90 (non-road cycles <http://www.epa.gov/oms/regs/nonroad/equip-hd/cycles/nrcycles.xls>). Cycle validation parameters are to be user-configurable through a parameter table. These requirements apply to all test engines, including those with both speed and torque priority engine control systems.

The contractor shall provide tools and functions for tuning control systems and analyzing results to efficiently achieve valid test cycles. Control system designs relying on “feed forward” control technology to attain valid cycle performance statistics are not encouraged. However, it is encouraged to provide a feed forward system as part of a “tool box” that can be utilized if and when required.

Once the engine MAP determination is complete, the time required to perform trial runs and tune control systems parameters in order to attain valid cycle performance statistics shall not exceed 3 hours. This shall be accomplishable by an experienced test cell operator, but shall not require any particular or specialized knowledge of control theory.

All tuning parameters shall be archived in such a way as to be readily available for immediate and future testing. These parameters shall be stored in association with the engine ID, configuration number, MAP identification and date established

- h) Both transient and steady state tests must be able to be “looped” so that any test can be run sequentially following another of like kind without restarting the program or any other piece of software or hardware.
- i) CVS Verification by propane injection (both bomb and CFO methods)
- j) Auxiliary Sampler/CVS Verifications

The delivered system shall include automated CVS verification routines per CFR along with automated routines to check propane concentrations at various sample point locations, including the secondary dilution, to demonstrate system integrity. Concentrations at these sample points shall be compared to the concentration of a sample taken immediately adjacent to the main flow venturi.

For calculation of all CVS verifications made by using a CFO kit utilizing pure propane, the density of pure propane at the CFO shall be assumed to be 52.83 grams/standard (1 atm., 20 deg C) cubic foot, for injected mass calculations. The density of diluted propane withdrawn from a sample system shall be assumed to be 51.90 grams/cubic foot for bag mass recovery.

- k) Verification/Calibration functions for interfaced measurement devices and analog I/O channels
- l) Instrument zero/span adjust
- m) Instrument zero/span verify, to include comparison of instrument-zero/span and overflow zero/span for the heated sample probes
- n) Bag leak check routine (CVS)
- o) Bag evac only
- p) Automated bag evac-purge-evac
- q) External bag sample read (through remote bag port)
- r) Dilution air sample read

- s) Sample transport and measurement delay time determination/signal alignment tool

2.2.24 All engine test procedures shall include test configuration options as follows:

- a) CVS sampling
- b) Bag sampling
- c) Continuous dilute sampling
- d) Continuous sampling of raw exhaust
- e) Particulate Matter (PM) sampling, configurable for simultaneous, independent sampling through 1, up to 4, filter holders
- f) Smoke measurement
- g) Auxiliary bag sampling
- h) Auxiliary continuous sampling, to include both mass spectrometer and other user configurable systems
- i) Combustion analysis system, if so equipment
- j) Recording of engine ECU parameters
- k) Charge-air cooling simulation

TDAP shall adjust emissions measurement results, as required, for sample removal invoked by the specific test configuration chosen.

2.2.25 Pretest information files will be available via EPA-IFC for all engine tests per the description found in Appendices C and D. Additional time of test information shall be acquired either automatically or via interactive dialog boxes and shall include:

- | | |
|--|-------------------------------|
| a) Test Site (dyno#, CVS#, analyzer #) | Automatic default entry |
| b) Date, time | Automatic default entry |
| c) Beginning engine hours | Automatic default entry |
| d) Ambient conditions (temp, baro, humidity) | Automatic default entry |
| e) Analyzer ranges | Automatic default entry |
| f) Test cycle (DCS4, SS, Smoke, etc.) | User selected from dialog box |
| g) Cold start/hot start | User selected from dialog box |
| h) Other test options per Section 2.2.24 | User selected from dialog box |
| i) W/aftertreatment (Y/N?) | User selected from dialog box |
| j) Set up comments | Text box |

All operator-defined pretest information shall be presented via dialog boxes with an option to edit if needed. Other parameters not listed above shall be automatically configured at the time of test initiation.

- 2.2.26 TDAP shall prompt for additional operator comments at the completion of each transient cycle or steady state mode. All comments shall be saved in the test results file and printed on the test report.
- 2.2.27 If the test included particulate determination, TDAP shall allow for separate post test entry of pre-test and post-test filter weights and associated filter numbers. This entry process shall also allow for entry of "remarks." TDAP shall then merge this information with the rest of the test data to produce a final emissions summary.
- 2.2.28 Where applicable, set-up information, for any automated processes that can carry over to future occurrences of that process, shall be automatically entered the next time that process is invoked as a default value. Examples include identification of devices and standards utilized, time intervals, pass/fail criteria, etc. Any default values shall be easily changed with a pull down menu of predefined selections, wherever possible, or text entries. All dialogue boxes utilized for collecting Pre-Test and Post-Test information, or set-up information for any automated process, shall be easily modifiable so as to accommodate future information requirements. Such modifications shall result in the incorporation of new data into the test record.
- 2.2.29 For all operations, TDAP shall display run time information on the main display screen in logical, hierarchical manner. A real time, scalable display vs. time (both as a line and as a numerical value) of any variable in the system shall be available on screen during a test sequence. Available display screens shall include a "hot-soak timer" which prominently displays a countdown timer for any mid-test non-engine operation event. This screen shall appear on the main display. For the FTP hot-soak period the display shall count down from 20 minutes, then up to +1 minutes. At +1 minutes a prominent message shall be shown on the main display to indicate that the allowable soak time has been exceeded. The operator shall be able to continue the test by responding to the dialog box above, and this action shall be automatically reported on the test report.
- 2.2.30 TDAP shall issue critical system status and critical alarm messages to the operator via the display screens.

TDAP shall monitor the status outputs, or other important non-parametric outputs, of all critical test cell sub-systems included in this contract, as well as EPA-provided systems. This shall include a before start check at the initiation of a test or other automated process, and constant monitoring during a test or other automated process. If any subsystem is not in “run” status at the beginning of the process, the process shall not be allowed to start without a manual override command. If a run status fault is detected at any point in the process, a warning or alarm message to that effect is displayed on the main display, and additional actions shall be configurable, based on the nature of the fault. Further, if the operator selects a manual override command, a message shall be printed on the test report indicating the nature of the overridden parameter. That information shall also be retained as part of the permanent test record.

The configuration of this function shall easily allow for future change or expansion of the function. To accomplish this monitoring function, the system shall utilize easily configurable and modifiable tables, specific to the operation being performed, to allow for easy designation of exceptional conditions as critical or non-critical and to define appropriate actions. Non-critical sub-systems shall be distinguishable from critical sub-systems. Parameter tables shall be printable for documentation purposes. The number of out-of tolerance events leading to an alarm status shall be individually adjustable for each channel to provide protection from false alarms.

Exceptional or non-nominal events or conditions shall be logged in files for posttest exporting and reporting.

NOTE: This function is separate from the safety shutdown function discussed elsewhere in this document. It is designed to avoid incomplete test data and/or voided tests, and is not intended as a redundant safety system.

- 2.2.31 TDAP shall monitor dynamometer status at the initiation of a test, and during a test. If the dynamometer is in run status no action is taken. If the dynamometer is not in run status at any point in the test sequence, an alarm message to that effect is displayed on the main display. This condition shall also trigger an emergency shutdown.

- 2.2.32 TDAP shall include a digital input for monitoring the Stand Alone Safety System, 1= normal, 0 = alarm, and display the alarm condition on the main display. This display will take precedence over any other display. Additionally, the TDAP shall incorporate a built in “watch dog” timer to respond in milliseconds to an internal software or hardware failure and to invoke an orderly shut down of the system and power.
- 2.2.33 TDAP shall monitor other critical parametric data during an automated process to ensure the quality of the process. These parameters shall be monitored against easily configurable and modifiable tables specific to the operation being performed. Parameter tables shall be printable for documentation purposes. Based on these limits, the system will issue warnings to the operator as warranted, if the quality of the procedure is likely to be compromised or if component failure may be imminent. The result of the quality monitoring process, including all warnings and exceptions shall be stored as part of the test data and summarized on a Quality Control Report.
- 2.2.34 Additional minimum requirements for the real time quality monitoring and reporting functions are found in Appendix F. The quality monitoring function shall also include any other parameters made critical to the quality and validity of the test by contractor-specific design.
- 2.2.35 A detailed specification of run time quality control shall be submitted to EPA for approval as described in the Schedule of Deliverables.
- 2.2.36 Report Requirements

All automated functions shall include an option to produce a summary report. For all reports, pertinent header information shall be presented on each page, sufficient to uniquely identify that each page is part of the same report. All pages of all reports related to engine tests shall contain the EPA test number for that test.

All reports and computer records produced to document engine tests and measurement instrument calibration/verifications shall minimally contain the following information:

- a) Name of Operation, Pertinent references
- b) Date and time of test or other operation, Operator
- c) EPA Test Site Designation

- d) Identification of devices and standards utilized, as applicable
- e) Data related to pertinent conditions, such as pressure, temperature, humidity
- f) All data directly related to the operation conducted
- g) Summarized data related to outcome such as coefficients, offsets, efficiencies, both “as found” and “as calibrated,” where applicable
- h) Other pertinent statistics to indicate quality of outcome such as regression statistics and other summary statistics
- i) Text-type notes and observations
- j) Pass/Fail indications and Accept or Reject indications, where applicable
- k) Units identified for all data
- l) Date and time of operation beginning and end, data processing date and time,
- n) Report pages shall also be labeled with date and time of report printing, current page number, total number of pages of the report and other pertinent header information sufficient to uniquely identify that each page is part of the same report.

Engine emission reports shall minimally also include information outlined in Appendix G for Transient or Steady-State Mode tests.

Cycle validation reports shall include time shifts, statistics and pass/fail indication.

MAP reports shall include a power curve and a summary of all relevant performance data including specified and measured results.

Available reports shall include a per phase or per mode summary of the minimum, maximum, average, standard deviation, and sum values of each active measurement channel.

Quality Control report requirements are outlined in Appendix F.

All reports shall be easily modifiable through a report builder function.

All report layout and content shall be approved by the EPA Project Officer, as indicated in the Schedule of Deliverables.

2.3 Dynamometers

- 2.3.1 The contractor shall supply, deliver, install and commission two (2) 4-quadrant AC flux-vectorized (motoring/absorbing) dynamometers as described in the following sections. The dynamometers must provide full power (nominally) and absorption when operated in either direction of rotation. The power and size requirements for each dynamometer are presented below.
- 2.3.2 The AC dynamometers shall utilize the latest technology in variable frequency, vectored, line regenerative, AC motor-absorbers that have been interfaced with a correctly designed and responsive torque, speed, and throttle measurement and control system. This shall perform the required transient motoring and loading tests, as described in the following text.
- 2.3.3 Dynamometers shall feature trunnion mounting, in conjunction with case load torque measurement, to include the load cell and, in conjunction with the TDAP, readouts for these values.
- 2.3.4 This contract shall include all power conversion hardware and peripheral equipment needed to make the system fully functional and meet the requirements of this Statement of Work. Power absorption shall be regenerative, wherein the generated power is delivered to the NVFEL building power grid. The power inverter and motor controller shall alter the motor-absorber electrical load forces to impose the required combination of engine torques and speeds at the specified times during the test sequence process.
- 2.3.5 The dynamometers, and associated control equipment, shall be interfaced with TDAP to facilitate manual and/or automatic functions as described in this document. The TDAP shall provide appropriate signals or communications to the motor controller, to control the power inverter and motor controller. The system, as delivered, shall accurately respond to load schedule values be based on specific equations, algorithms, parameters, time-based data, and/or test specifications.

In all cases, the loading and motoring abilities, control algorithms, and other operating characteristics shall control the torques and/or speeds specified in the load schedule and/or test process with the specified resolution, accuracy, and precision.

- 2.3.6 The dynamometers shall be designed and constructed to operate on a continuous basis. They shall withstand all static and dynamic loads encountered during engine testing, and shall not produce vibrations which impair the operation of the engine, dynamometer, and auxiliary test systems. The dynamometers shall withstand shock loading from maximum acceleration/deceleration loads such as wide open throttle (WOT), emergency shut down, and of any system malfunction that induces abrupt loads, without damage to any component.
- 2.3.7 The dynamometers shall be protected from uncontrolled acceleration. The dynamometers shall have current limit protection to prevent system damage from power grid faults of short duration (<20 ms).
- 2.3.8 The activation of an emergency stop (E-Stop), whether manually or electronically induced, shall invoke an orderly shutdown process. As an example, the dynamometer must be returned to zero speed before the drive system power is interrupted.
- 2.3.9 All bearings, supports, and/or coupling devices shall provide minimal and stable frictional losses. All bearings shall have a service life of at least 50,000 hours at the rated speed of the dynamometer, and shall be designed to operate at the maximum speed and load. All lubrication points shall be easily accessed and well documented. The frictional losses of the dynamometer shall remain within ± 0.1 hp of the final stabilized value after a ten minute warm up period at rated speed. Trunnion bearings shall be designed to avoid deterioration, such as brinelling of the races.
- 2.3.10 The equipment to perform a dead weight calibration of the dynamometer load measurement devices shall be provided, as specified in 40CFR86.1304-84. One set of calibration weights that cover the range and increments for each dynamometer, and a common load arm, are acceptable as long as calibrations can be performed that meet the requirements in the above-cited CFR reference. Each weight and the load arm must be proven to meet the CFR requirements and the weights, and load arm length, expressed in consistent SI units, must be certified to a NIST-traceable source prior to delivery. Furthermore, each calibration weight shall have an uncertainty of 0.05% or less. The moment arm length shall have an uncertainty of 0.05% or less. The calibration system shall be designed to control any errors introduced by physical deflection during loading to less than 0.05%.

- 2.3.11 A power conversion system shall be provided suitable to power the dynamometer in all modes of operation and shall utilize the IGBT technology. This system must also deliver the output power in a form compatible with use to power the NVFEL building power grid.

The dynamometer control circuits shall be designed and installed in such a way as to minimize and reject electrical noise. The system shall not feed damaging or detrimental electrical noise into the power grid. Electromagnetic fields (EMF) caused by the dynamometer shall be controlled or suppressed to prevent any interference to the test engine, auxiliary equipment, cell instrumentation or the dynamometer electrical/electronic systems themselves. The contractor shall provide and install any isolation devices as may be needed to meet this requirement. The dynamometer and related equipment shall maintain a power factor greater than .90 and shall meet the IEEE-519 specification for noise and harmonic distortion.

The dynamometer control circuits shall be designed and install in such a way as to prevent any power from being sent to the building grid if normal facility power is lost.

- 2.3.12 A speed encoder shall be provided for each dynamometer and installed, and shall provide readings of speed, safety interface, and means to effect calibration. A tachometer/generator does not fulfill this requirement. The encoder shall provide an instantaneous indication of direction of rotation. Further, a separate dedicated speed readout shall be provided as part of the operator's console. The encoder shall be drift-free, require no analog calibration, and shall determine speed within 10 ms of true occurrence. Indicated speeds, from 50 rpm to the maximum speed of the dynamometer, shall be accurate to within ± 1 rpm, and shall have a display resolution of 1 rpm.

Acceleration and deceleration rates (rpm/sec) shall be determined by electronic and numerical methods. Acceleration rates shall be accurate to within ± 1 rpm/sec or $\pm 1\%$ of the rate, whichever is greater, and shall be determined within 20 ms of true occurrence.

- 2.3.13 A contactless, non-rotary in-line transformer torque transducer, with a total uncertainty of less than 0.5% of rated load, shall be provided with each dynamometer. The range shall be appropriate for the dynamometer, with adequate over-range to prevent sensor failure due to torque spikes. Antennae, amplifiers, cabling, and any other equipment needed to make the system functional shall be provided. This device shall be interfaced with the TDAP, providing readings of torque, safety interface, and means to effect calibration.

A separate, dedicated torque readout shall also be provided as part of each operator's console. The device shall provide for direct bolt up to EPA drive shafts, which are equipped with Spicer 1810 Series Flange Yokes.

- 2.3.14 A case load measurement device shall be provided for each dynamometer with a total uncertainty of less than 0.5% of rated output. The range shall be appropriate for the dynamometer, with adequate over-range to prevent sensor failure due to torque spikes. Amplifiers, cabling, and any other equipment needed to make the system functional shall be provided. A straight forward means of utilizing the dynamometer in the absence of a case load cell shall be provided.
- 2.3.15 The following are additional performance specifications for both in-line and case torque measurement systems:

Hysteresis:	Less than $\pm 0.1\%$ of rated output
Zero/shunt cal drift	Less than $\pm 0.1\%$ of rated output in a 24 hour period
Non-repeatability	Less than $\pm 0.05\%$ of rated output
Non-linearity	Less than 0.1% of rated output (see note)
Overload protection	300% of rated output without physical or electrical damage

NOTE: Non-linearity is defined as the maximum deviation from a straight line connecting the zero and \pm full scale values, expressed as a percent of the rated output, at any load point between zero and \pm full scale.

A means shall be provided to perform a shunt calibration of both the in-line and case load measurement systems. All components utilized for this function shall provide a highly accurate, precise signal, unaffected by the range of conditions normally experienced in an engine test cell environment, providing excellent long term signal stability.

- 2.3.16 Each dynamometer shall be equipped with instrumentation for measuring and monitoring vibration. This function shall provide for emergency shutdown of the engine and dynamometer if excessive levels of vibration are detected.

HD Dyno 2

- 2.3.17 A dynamometer nominally rated at 750 HP shall be provided, delivered, installed, and commissioned in this test site. Specifications:

Rated absorbing HP	750 (nominal) at base speed
Rated motoring HP	$\geq 80\%$ of absorbing HP at base speed
Maximum speed	$\geq 4,000$ rpm
Base speed	≤ 2000 rpm (nominal)
Rated torque range	≥ 2000 lbs-ft (nominal) from 100 rpm to base speed
Over torque range	125% of full torque
Torque regulation	$\pm 1\%$ of commanded value or ± 0.5 lbs-ft, whichever is greater, within acceleration rates of ± 1500 rpm/sec
Moment of Inertia	Not to exceed 12 kg m^2
Dynamic balance	ISO G-2.5 or better
Length	≤ 80 inches
Width	≤ 72 inches
Height	≤ 72 inches
Shaft centerline height	30 to 36 inches above bed plate

HD Dyno 4

2.3.18 RESERVED

2.3.19 RESERVED

2.3.20 A dynamometer nominally rated at 600 HP shall be provided, delivered, installed, and commissioned in this test site. Specifically:

Rated absorbing HP	600 (nominal) at base speed
Rated motoring HP	≥80% of absorbing power at base speed
Maximum speed	≥5,500 rpm (nominal)
Base speed	≤2,000 rpm (nominal)
Rated torque range	≥1500 lbs-ft (nominal) from 100 rpm to base speed
Over torque range	125% of full torque
Torque regulation	± 1% of commanded value or ± 0.5 lbs-ft, whichever is greater, within acceleration rates of ± 1500 rpm/sec
Moment of Inertia	Not to exceed 10 kg m ²
Dynamic balance	ISO G-2.5 or better
Length	≤ 72 inches
Width	≤ 66 inches
Height	≤ 72 inches
Shaft centerline height	30 to 36 inches above bed plate

2.4 Throttle Controller/Amplifier/Servo

- 2.4.1 A throttle controller/amplifier/servo shall be provided for each test cell systems.
- 2.4.2 The contractor shall provide the throttle controller/amplifier/servo as an installed and integrated system, including all necessary hardware and software, to provide two modes of throttle or engine fueling rack operation. A means shall be provided to operate a servo to physically move a throttle arm or rack control, and a method shall be provided to generate an analog voltage, to command set points to an engine control computer for electronically-controlled engine systems.
- 2.4.3 The servo controller shall include all necessary mounting fixtures, hardware, cabling and adjustable linkages to facilitate attachment to a wide range of injector racks, throttle potentiometers, or other fuel metering devices. This system shall move any fuel metering device from closed to fully open position (90 degrees) in 0.25 seconds or less, and shall exert a force of at least 45 inch pounds. The servo shall automatically return to closed or 0% throttle position if power is interrupted to the actuator. The actuator shall self-calibrate its travel as a percent of wide open throttle (WOT), and shall adjust feedback signals to assure tunable response and a stable fixed throttle holding action. The TDAP system shall continuously record the throttle position (xx.x% of WOT)..
- 2.4.5 The servo and attendant amplifier shall be provided installed, along with all hardware, wiring and sensors needed to make the system fully functional.

2.5 Performance Requirements for Control of Speed and Load for Transient Testing

- 2.5.1 The engine and dynamometer control systems, throttle controllers and other components delivered under this contract are expected function together to provide excellent transient control of the engine and dynamometer as a system. EPA expects to use these test systems for a wide range of engine types, configurations, power outputs and torque characteristics.

- 2.5.2 The dynamometer control systems and components shall produce a critically damped torque response (see Figure 5 for second order response definitions) which reaches 90% of a stable final value within 100ms of a step change in demand torque, as measured by an acceleration / deceleration test between two speeds of a spinning flywheel. This requirement assumes that the inertia of the flywheel, speeds, and the acceleration rates are set to generate a force that is about half the rated torque of the dynamometer.
- 2.5.3 The dynamometer and engine control equipment provided by this contract shall be configured to optimize transient control of the engine and dynamometer as a system. Tuning to achieve satisfactory cycle performance statistics shall be easy and precise, with any adjustable parameters presented in engineering units.
- 2.5.4 All transient test cycles must meet the statistical tests for validity, as detailed in 40CFR86.1341-90. These requirements apply to all test engines, including those with both speed and torque priority engine control systems. Designs relying on “feed forward” control technology to attain valid cycle performance statistics are not encouraged. However, it is encouraged to provide a feed forward system as part of a “tool box” that can be utilized if and when required.
- 2.5.5 The mode of dynamometer and throttle operation (speed/torque) shall be switch-selectable by the operator or selected by the TDAP, with the selection of either mode disabling the other. All transfers are to be “bumpless.”
- 2.5.6 Once the engine MAP determination is complete, the time required to perform trial runs and tune control systems parameters in order to attain valid cycle performance statistics shall not exceed 3 hours. This requirement assumes operation by an experienced test cell technician, but achievement of the requirement shall not require any particular or specialized knowledge of control theory.

2.6 Stand Alone Safety System

- 2.6.1 For each TDAP system delivered, the contractor shall provide a separate stand-alone safety shutdown system to either return the engine to idle/closed throttle, soft stop or hard stop, selected through user-defined commands.
- 2.6.2 Actions initiated from this system shall take precedence to all other engine and dynamometer operating commands.

- 2.6.3 The system shall accept at least 16 safety input channels, with user-defined limits and resultant actions. Each channel shall accept a normally open or normally closed dry contact or a logic level input.
- 2.6.4 This system shall feature an annunciator panel that will display the violated safety limit and its value. This display shall give a clear indication of the “first out” condition.
- 2.6.5 The system shall allow “yellow”(warning) and “red” (danger) limits for each monitored parameter, with varying resultant actions, user selectable. Separate relay outputs shall be provided for the yellow and red conditions.
- 2.6.6 All user selectable actions shall be protected from unauthorized change. Examples of such protection would be password protection or restricted operator level access. A timed bypass shall override faulted channels, with bypass times user-selectable. An example of the utilization of this would be to override oil pressure limits during start up.
- 2.6.7 The electronic parameters of the delivered safety system shall be designed and configured in such a way as to absolutely minimize the occurrence of false alarms, while providing a highly reliable response to actual emergencies.

2.7 Test Cell Instrumentation Interface

- 2.7.1 Each TDAP system provided under this contract shall include a test cell instrumentation interface or “boom” to facilitate connections from the subject test engine to the TDAP and other control room instrumentation.
- 2.7.2 Each system shall consist of an in-cell box and a pivoting mounting system to allow moving the boom out of the way for engine installations, etc. Permanent, accessible metal conduits shall be provided from the boom to the data acquisition hardware.
- 2.7.3 This system shall be modular in nature, and provide for additional instrumentation to be added in response to future needs without the need for physical modification of the boom.

- 2.7.4 Thermocouple terminations to the isothermal junction shall be made within the boom so that wiring to the data acquisition hardware can be run in plain copper wire.
- 2.7.5 At least 16 pressure transducers (see Appendix E) shall be mounted in the boom, and terminated on the front of the box with 1/4" tubing bulkhead connectors, compatible with Parker-Hannifin® or SwageLoc® compression fittings.
- 2.7.6 Two power supplies providing 12 VDC to 24VDC (adjustable) @ 60 amps, shall be provided by the contractor as part of the instrumentation package. A power receptacle for 120VAC @ 20 amps shall be provided. One of the DC power supplies shall be switched from the control room, and controllable by the TDAP system. The other DC power supply and the 120VAC shall be "ON" whenever the dynamometer is powered.
- 2.7.7 The boom shall be provided, installed, wired to the data acquisition equipment in the control room. All sensors and features (power supplies, etc.) shall be wired to the supporting hardware in a manner making all functions operational.

3.0 Other Support Equipment

- 3.0.1 The contractor shall supply, install and integrate an electronic barometer with an accuracy of 0.03 inches mercury, or better, for each TDAP system delivered.
- 3.0.2 The contractor shall supply, install and integrate an electronic hygrometer and dry-bulb temperature instrument, Vaisala® HMP 233 with remote display, for each TDAP system delivered.
- 3.0.3 Operator's consoles shall be provided, delivered, installed, and commissioned for each TDAP system delivered. These shall be similar in design to that in the south end of room 413, as shown in Figures 2 and 4. These consoles shall be fitted with fixed, independent readouts of speed and torque, as well as potentiometers (real or virtual) to adjust speed and load during semi-automated test functions.
- 3.0.4 Cabinets shall be provided adequate to contain all equipment provided under this contract, including TDAP, throttle controller/amplifier, stand-alone safety monitor, and/or other hardware as required for system function. Cabinets shall provide adequate filtered ventilation and interior access on three sides.

- 3.0.5 Except as noted elsewhere, the contractor shall provide a supply of consumable items sufficient for approximately 6 months of operation of all equipment provided as part of this contract.

4.0 Documentation Requirements

- 4.0.1 The contractor shall provide complete documentation for each system in this contract, including wire lists, color coding, electrical schematics, piping/tubing diagrams, operating and repair manuals and computer system documentation, including source code.
- 4.0.2 For each system a minimum of four sets of each document shall be provided and when available, the contractor shall also provide the documentation in computer readable user modifiable form. Microsoft Word, WordPerfect, AutoCAD, VectorWorks and Microsoft Excel are acceptable file formats as well as any that are compatible with standard translator/conversion tools provided by those applications. Proprietary formats within the control of the contractor shall be provided with the understanding that the EPA will not share these formats outside of the Agency.
- 4.0.3 The contractor shall provide a recommended calibration, verification and preventative maintenance plan, which will detail calibration, verification and preventative maintenance procedures, schedules, and recommended spare parts inventory.
- 4.0.4 The contractor shall provide a listing of all proprietary system warning and alarm messages, with full explanation as to their exact meaning, impact and action required.
- 4.0.5 The contractor shall provide a complete "Lock-Out, Tag-Out" instructions for equipment requiring energy-isolating devices in accordance with the OSHA rule on the Control of Hazardous Energy (Lockout/Tagout) of Title 29 of the Code of Federal Regulations (29 CFR) Part 1910.147. These instructions shall be based on the specific "as installed" configuration of all equipment delivered under this contract.

- 4.0.6 The contractor shall provide complete documentation of the quality control features of the delivered systems, and instructions as to their maintenance and utilization. This documentation shall be sufficient to provide system documentation and instruction to satisfy the relevant requirements of ISO DIS 17025 - General Requirements for the Competence of Testing and Calibration Laboratories
- 4.0.7 The contractor shall supply a list of standard replacement items with recommended supply sources, as well as a recommended parts list for routine maintenance operations.
- 4.0.8 All specifications in Section 4.0 shall apply to all items delivered under this contract, including both required items and options.

5.0 Acceptance Testing Requirements

- 5.0.1 The contractor shall develop a comprehensive final acceptance plan, approved by EPA, which will verify and demonstrate that all requirements contained in this Statement of Work, and referenced documents, have been achieved in the delivered system(s). The initial verification will take place at the contractor's point of final assembly prior to delivery of the system to EPA.

The contractor shall deliver the acceptance plan, satisfactory to the EPA Project Officer, at least 90 days prior to the start of the acceptance process. Prior to commencement of acceptance testing, the EPA Project Officer must approve the acceptance plan in writing. Once approved, the contractor shall provide the EPA Project Officer with a detailed schedule of acceptance activities at least 21 days in advance. The Project Officer (or his/her representative) shall have the right to observe any or all pre-shipment acceptance testing. At least 7 days in advance, the Project Officer will indicate which activities EPA personnel will observe.

- 5.0.2 The acceptance shall be based on demonstrated performance, including actual engine testing. The EPA will provide (on loan) a test engine for the duration of the acceptance testing, with expenses for shipping, engine set-up etc., to be paid by the contractor. The contractor will repeat this verification process again after installation at NVFEL to the extent necessary to verify full compliance with the requirements in the final installation.

The plan shall consider all aspects of measurement system variability, so that all test results demonstrate compliance with an estimable and high level of statistical confidence. Acceptance testing shall include the evaluation of status monitoring, fault detection, and quality control features by purposely inducing fault conditions.

- 5.0.3 All acceptance testing shall be the responsibility of the contractor. The contractor, at the contractor's expense, shall rectify all non-compliant conditions. All repairs or changes shall be performed in a timely manner, on a schedule approved by the Project Officer. If repairs or changes are made, the contractor shall repeat acceptance testing to demonstrate the acceptable quality of the final product, to the extent necessitated by the scope of the repair or change. The contractor shall prepare a report for each phase of acceptance testing that describes all the various tests and reviews conducted as part of the acceptance activity, the outcomes of those tests, and a description of follow up actions, as required.
- 5.0.4 EPA personnel shall observe the acceptance process. The EPA Project Officer may waive the opportunity to observe certain aspects of the acceptance process.
- 5.0.5 The acceptance plan shall be cross-referenced, section by section in a straightforward manner, to the requirements of this Statement of Work. The plan shall be designed in such a manner as to also form the basis of a final acceptance report. The acceptance plan shall also address all other requirements deemed significant and appropriate by the contractor, based on the specific design and configuration of their system and significant operational features.
- 5.0.6 Upon completion of the off-site testing, the contractor shall deliver a preliminary acceptance report to EPA. This report shall provide documented evidence of compliance to the requirements of this Statement of Work and the Acceptance Plan, with content and format suitable for successful audit to ISO DIS 17025 standards.
- 5.0.7 Engine testing portions of the acceptance activity shall be performed at a sufficient range of conditions and over a sufficient range of test types to fully and statistically demonstrate compliance with the requirements of this Statement of work and applicable regulatory requirements.
- 5.0.8 Acceptance activities shall include an evaluation of the potential for aliasing or other inadvertent system effects on precision and accuracy.

- 5.0.9 All specifications in Section 5.0 shall apply to all items delivered under this contract, including both required items and options.

6.0 Warranty

- 6.0.1 Contractors shall warrant the performance and function of all products delivered under this contract for a minimum of one year after formal EPA system acceptance and approval.
- 6.0.2 This warranty shall provide for cost-free repair or replacement of covered hardware and software. This warranty shall not reduce any requirement in this Statement of Work.
- 6.0.3 All specifications in Section 6.0 shall apply to all items delivered under this contract, including both required items and options.

7.0 Training

- 7.0.1 After the systems have been commissioned and preliminary acceptance tests have been completed, the contractor shall provide at least 16 hours of basic training for up to 8 people and 24 hours of advanced training and systems administration for up to 6 people. The content of advanced training shall be selectable by EPA. This training shall be conducted on the installed system at NVFEL or at a mutually acceptable location. The training shall be completed within 30 days of final system acceptance by EPA.
- 7.0.2 All specifications in Section 7.0 shall apply to all items delivered under this contract, including both required items and options.

8.0 Optional Equipment

- 8.0.1 All optional equipment provided under this system shall be subject to all general requirements of this Statement of Work and the requirements of Sections 3, 4, 5, 6 and 7, as well as other requirements stated below.

8.1 Option for a Third TDAP System

- 8.1.1 The contractor shall offer an option to provide an additional, complete Test-Control, Data Acquisition and Processing System, Throttle Controller/Amplifier/Servo, Stand Alone Safety System, Test Cell Instrumentation Interface and Section 3.0 equipment, as referenced in Section 1.3.2 of this SOW. A schematic of the physical layout of this cell will be provided when this option is exercised. This system will incorporate the same component features of the systems described above.
- 8.1.2 EPA has yet to determine which existing test site will receive this upgrade, therefore exact interface details remain to be determined. For bidding purposes, it can be assumed that the interface will be no more complex than the interface described in this document for HD Dyno 2.
- 8.1.3 The general operation and configuration of this system shall be equivalent to the TDAP systems described above for all included features, so that operations and support personnel can operate any delivered system with optimum efficiency.

8.2 Option for Combustion Analysis Systems

- 8.2.1 The contractor shall offer a combustion analysis system to be purchased at an option to this contract. The Government may choose to purchase one system for each TDAP system purchased under this contract.
- 8.2.2 This system will be comprised of all software and hardware necessary to monitor, record, and retrieve all data required to yield in-cylinder combustion analysis.

This system shall monitor:

- a) Crankshaft angle measurement to within 0.1 degree, with TDC reference
- b) In-cylinder pressure measurement - linearity to within $\pm 0.5\%$ of full scale, accuracy to be determined through calibration
- c) Fuel injection needle lift indication - must indicate open/closed, preference given to systems that indicate amount of opening in engineering units (mm, inches)
- d) Intake manifold absolute pressure - range -1 to +5 bar (nominal), accuracy: 0.25% full scale (linearity, hysteresis, repeatability)

8.2.3 This system shall meet, at a minimum, the following basic specifications:

- a) 8 digital I/O channels
- b) 200kSps, 14 bit resolution
- c) 8 differential inputs w/filters

Additional specifications for the combustion analysis systems are presented in Appendix H.

8.2.4 The contractor shall interface this system's operational inputs and data outputs with TDAP in such a way that all combustion analysis functions can be initiated from TDAP, and all data output can be accessed, stored, and downloaded from TDAP, time aligned with other data acquired concurrently.

8.3 Option for Extension to Base Warranty

8.3.1 Contractors shall offer options for 1-year and 2-year extensions to the base warranty period. These options shall be exercisable for up to 90 days after final system acceptance by EPA.

Figures

- Figure 1. Test Site System Architecture
- Figure 2. HD Dyno 2 Layout
- Figure 3 HD Dyno 4 Layout
- Figure 4 Example Console

All Figures are contained in the Acrobat.pdf file

Appendices

Appendix A

Abbreviations and Terms

AISC	-	American Institute of Steel Construction
ASHRA	-	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
BMD	-	Bag Mini-Diluter
BOCA	-	Building Officials' Code of America
CAA	-	Clean Air Act Amendments
CARB	-	California Air Resources Board
CFH	-	Cubic Feet per Hour
CFM	-	Cubic Feet per Minute
CFO	-	Critical Flow Orifice
CFR	-	Code of Federal Regulations
CFV	-	Critical Flow Venturi
CL	-	Chemiluminescence Analyzer (NO _x)
CNG	-	Compressed Natural Gas
CVS	-	Constant Volume Sampler
DF	-	Dilution Factor, expressed as (parts diluent + parts sample)/parts sample
DR	-	Dilution Ratio, expressed as parts diluent : parts sample
EFMS	-	Exhaust Flow Measurement System
EPA	-	Environmental Protection Agency
FID	-	Flame Ionization Detector
FM	-	Factory Mutual
FTIR	-	Fourier Transform Infra Red
FTP	-	Federal Test Procedure
HEPA	-	High Efficiency Particulate Absorption
HZ	-	Hertz (cycles per second)
IFC	-	InterFace Computer
IGBT	-	Insulated Gate Bi-Polar Transistor
ISO	-	International Standards Organization
LPM	-	Liters Per Minute
LNS	-	Laboratory Network System
MFC	-	Mass Flow Controller
MSDS	-	Material Safety Data Sheets
NDIR	-	Non Dispersive Infra Red
NEC	-	National Electrical Codes

NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Prevention Association
NIST	-	National Institute of Standards and Technology
NMOG	-	Non-methane Organic Gas
NVFEL	-	National Vehicle and Fuels Emissions Laboratory
OSHA	-	Occupational Safety and Health Administration
PID	-	Proportional/Integral/Derivative Control Algorithm
PM	-	Particulate Matter
P/N	-	Part Number
POC	-	Point of Contact
PSIA	-	Pounds per Square Inch Absolute
PSIG	-	Pounds per Square Inch Gauge
RFP	-	Request for Proposal
RPM	-	Revolutions Per Minute
RTD	-	Resistance Temperature Detector
SAE	-	Society of Automotive Engineers
SCFH	-	Standard Cubic Feet per Hour
SCFM	-	Standard Cubic Feet per Minute
SOW	-	Statement of Work
SJI	-	Steel Joist Institute
SLPM	-	Standard Liters Per Minute
T90	-	Time for an instrument to reach 90% of it's eventual reading for a given, constant condition
TDAP	-	Test-control, Data Acquisition and Processing system
UBC	-	Uniform Building Codes
VAC	-	Voltage w/ Alternating Current
VDC	-	Voltage w/ Direct Current
WC	-	Water Column

Appendix B

General Description of EPA Test Site Instrument Interface Requirements

The following is a list of current EPA test site equipment that shall be interfaced to the new systems provided under this contract for data acquisition and control.

<u>Component/System</u>	<u>Type of Signal</u>
1) Barometer	Analog DC voltage
2) Dewpoint	4-20 mA
3) Ambient temperature	4-20 mA
4) Celesco smokemeter	Analog DC voltage
5) Airflow meter	4-20 mA
6) AVL smokemeter	4-20 mA & serial
7) Fuel flow meter	4-20 mA, DC analog, digital logic control
8) MAF sensor	Analog DC voltage
9) NGK Nox sensors (6 ea.)	Analog DC voltage
10) CVS microcomputer interface	TCP/IP
11) Horiba Mexa 7000 Series Analyzer System (dilute exhaust)	TCP/IP
12) Future raw exhaust gas analyzer system	TCP/IP
12) PM Sampler	TCP/IP
13) Raw CO ₂ analyzer	Analog DC voltage with digital logic control
14) V&F Mass Spec	Analog voltage

Appendix C

Description of EPA Interface Computer (IFC) and TDAP/IFC Interface Requirements

This appendix describes the interface requirements of the TDAP with the EPA supplied IFC.

EPA shall provide the IFC. In 2002 the standard EPA IFC utilizes the Windows NT 4.0 operating system. EPA NVFEL expects, in 2003 through 2005 to complete migration away from the Windows NT 4.0 operating system to Windows 2000. Use of Windows XP, Linux/Unix and later version of Windows operating systems may also need to be supported. The IFC will adhere to the NVFEL Laboratory Network System requirements in Figure 1 except as described in the following sections.

1.0 Configuration

1.1 Hardware

Pentium PC

Windows NT 4.0 or 2000

1.2 Software

Full installation of Microsoft Office 2000

Oracle Client Tools and Net 80

1.3 Communication Protocols

TPC/IP network protocol

NETBUI network protocol

1.4 Network Identification

Workgroup/Computer Name/Workgroup will be - IFC/SITE_D239 or IFC/SITE_D002 or IFC/SITE_DO05

2.0 File Transfers Overview

Visual Basic File/Directory Commands Used by IFC with TDAP. The contractor shall ensure that Visual Basic software, executing on the IFC, is able to control and supervise TDAP file and TDAP file-directory management utilizing disk drive, file directory and file management statements, summarized below.

- 2.1 The EPA IFC computer programs will utilize drive mounts or similar connections to enable Visual Basic applications to navigate directories and maintain files on the TDAP system disk drive. Example: NFS Software has been utilized at some NVFEL test sites with Unix OS TDAPs to satisfy this requirement.
- 2.2 Specific Visual Basic Statements to be utilized include:
 - ChDir
 - ChDrive
 - RmDir
 - Dir
 - CurDir
 - Kill
 - Name
 - FileCopy

3.0 TDAP/IFC During Testing Operations

- 3.1 Before Testing Operations - Visual Basic software running on the IFC files will control and supervise the transfer of files to established file directories on the TDAP. Such files will include configuration information, engine information and testing parameters necessary to conduct TDAP operations.
- 3.2 Test Time Operations - There shall be no TDAP requirements or dependencies for interaction with IFC and any LNS components during test time operations. TDAP shall be immune to LNS and IFC network traffic. An EPA-NVFEL network switch shall ensure isolation of the test site from non-test site network traffic.
- 3.3 After Testing Operations - Visual Basic software running on the IFC files will control and supervise the transfer of files from established file directories on the TDAP to the IFC and LNS computers. Visual Basic software running on the IFC files will control and supervise the cleanup of files and established file directories on the TDAP.

4.0 TDAP/IFC During Calibration and Maintenance Operations

- 4.1 During System Instrumentation Calibration and Maintenance Procedures - There shall be no interaction with the IFC and any LNS components.
- 4.2 After Calibration and Maintenance Procedures - Visual Basic software running on the IFC files will control and supervise the transfer of files from established file directories on the TDAP to the IFC and LNS computers. Visual Basic software running on the IFC files will control and supervise the cleanup of files and established file directories on the TDAP.

5.0 File Formats

Files shall be formatted as indicated below, and according to the General Interface Guidelines in Appendix D.

- 5.1 Pretest variable names, formats and definitions

A complete listing of Pretest variable names is presented in Appendix D.

TDAP/IFC shall receive and utilize engine and other pre-test information from the Laboratory Network System.

Pre-test Formats

TDAP shall utilize variable names, formats and definitions as specified

Two formats are acceptable, as follows.

Format 1:

- text file
- no quote "" or comma ',' characters allowed
- lines terminated with carriage return <CR> and line feed <LF> characters
- <CR> and <LF> at the end of lines are the only non-printing characters allowed
- Each line contains
- Value name
- Space character <SP>

Equal sign '='
 Space character <SP>
 Value string
 text string | numeric code <SP> code text | numeric | numeric <SP> units

Example:

```

VariableName<SP>=<SP> value string <CR><LF>
TestNumber = 20020001278
Preferred Filename = "P_" & Format(TestNumber,"0000000000") & ".txt"
    = "P_20020001278.txt"
  
```

Sample File Content (Partial List)

```

NOx_BKG=0
HC_BKG=0
CO2_BKG=0
CO_BKG=17.559
CH4_BKG=0
FHCR=1.85
timAnalyzeCoTransport=0
timAnalyzeCo2Transport=0
timAnalyzeHcTransport=0
timAnalyzeNoxTransport=0
timAnalyzeCh4Transport=0
FuelType=
FuelContID=None
GovType=
idEng=Cummins B1
idEngMfr=Cummins
numEngConfig=1
OPERATOR_ID=
dewpt=10
spEngRated=2500
tqPeakTorque=856
spEngIdle=800
spEngIntermed=1600
  
```

tqRatedSpeed=684
TransientScheduleName=
tqCITT=0
ENG_DISPLACEMENT=
MapTestFileName=

Format 2:

A text file bearing

<VariableName><TAB><value string><CR><LF>

5.2 Post-test variable names, formats and definitions

The format of these files shall follow the general interface guidance in Appendix D and Appendix. The specific file format is negotiable.

5.3 Calibration and Maintenance variable name, formats and definitions

The format of these files shall follow the general interface guidance in Appendix D. The specific file format is negotiable, but must be approved, in advance by the EPA Project Officer.

Appendix D

General Interface Guidelines

1.0 General Site Interface & File Formats

This appendix provides a general guidance, where applicable, in the absence of other specific guidance in this Statement of Work.

1.0.1 Network Requirements

The site computer system provided as part of the system shall be compliant with EPA-NVFEL network requirements.

1.0.2 Communication Protocol

The site computer system provided as part of the system shall be compliant with EPA-NVFEL communication protocol requirements.

1.0.3 File Transfer

All files created by the site computer system provided as part of the system shall be transferable in a batch file selection and transfer mode. File transfers shall not be restricted to interactive file selection or to a single file transfer. All files shall be transferable via network interface and via removable storage media. File transfers shall not be restricted to proprietary methods or formats and shall use Commercial-Off-The-Shelf (COTS) software wherever possible. FTP file transfer shall be feasible between the site computer and the IFC.

1.0.4 File Format

Standard ASCII Formats (SAF) shall be used wherever available for files created by or sent to the site computer systems. Delimited ASCII Formats (DAF) shall be used for files created by or sent to the site computer system in all cases where SAFs are not available. For DAFs, the field names shall appear on the first line, data types shall appear on the second line, engineering units shall appear on the third line, and the field values shall appear on the fourth line and below. More specific DAF requirements appear below.

- 1.0.4.1 The field names shall appear on the first line and the field types, engineering units values shall appear on lines two and below.
- 1.0.4.2 Dates shall be in “mm/dd/yyyy” formats. Time shall be in “hh:mm:ss” formats.
- 1.0.4.3 Real numbers, except for whole numbers, shall be in exponential (ñ.nnnnnnEñnn) formats.
- 1.0.4.4 Values that are not applicable for a particular field shall be filled in with a missing data code value of “-9.999E-99” for real numbers and “99” for characters.
- 1.0.4.5 Field names shall not contain embedded blanks. Instead, underscores may be used to delimit.
- 1.0.4.6 Numeric data shall be right-justified and character data shall be left-justified.
- 1.0.4.7 The test report number shall follow the site computer naming convention. Export files containing data that synchronize with site computer data shall use the site computer test report number for identification.

1.0.5 Ease of File Editing and Installation

The site computer system provided as part of the system shall be able to accept, validate, and use files that have been prepared or edited on external computer systems without further modifications. Installation of files shall be accomplished through a common user-friendly graphic interface rather than through cryptic installation procedures involving the typing of operating system commands or navigating through disk-drive, directory and file icons.

1.0.6 File Description

Information and format specifications for files that are created by or sent to the site computer system appear in Sections 1.0.6.1 to 1.0.6.13. For other files not described here, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.1 Test Site Configuration Files

Test site configuration files shall identify the major site components in use, model information, software versions, and parameters that may be useful to emissions test site instrumentation, including the site computer system.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.2 Dynamometer Configuration Files

Dynamometer configuration files shall identify the major dynamometer components in use, model information, software versions, and parameters that may be useful to other emissions site instrumentation, including the site computer systems.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.3 Site Computer and Instrumentation system Configuration Files

Site and instrumentation system configuration files shall identify the major site and instrument components in use, model information, software versions, and parameters that may be useful to other emissions test site instrumentation.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.4 Site and Instrumentation Options Selection and Control Parameters Files

Files that include the option selections and any control parameters shall contain all user selections and all modifiable site/instrumentation parameters that control site performance aspects.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.5 Test Sequence Control Schedules and Parameters Files

Test procedure control schedules shall contain traces of time versus analog/digital signal values (e.g., torque, speed). Test procedure parameters shall describe the test time events (e.g., startup and shutdown methods) corresponding to the analog/digital signal values.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.6 Engine and Test Parameter Files

Engine and test parameter files shall include information necessary for engine identification and operation under test conditions. Engine identification shall include key database fields used to tag data files.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.7 Test Definition Files

Test description files shall include information necessary to select test descriptions, test sequence control and parameter, drive schedules, shift schedule, engine and test parameter files to be used in a single instance of a engine test.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.8 Mode Definition Files

Mode definition files shall describe the modes of a test description and shall identify the type, beginning trace time, duration in seconds, and ending trace time of each mode.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.9 Acquired Hertz Data Files

Where applicable, acquired Hertz data files contain recorded analog or digital values gathered at specific frequencies during tests. Data recorded at different frequencies will require separate files.

The format for acquired Hertz data files shall be DAF with one data field per column and corresponding field names in the first row.

1.0.6.10 Acquired Non-Hertz Data Files

Acquired non-Hertz data files contain data not recorded at steady frequencies during tests.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.11 Input File Validation Reports

The site computer shall be able to accept, validate, and use files that have been prepared by external systems. If the file is not usable, the site computer shall generate a file validation report clearly identifying conflicts, as well as all formatting and content errors in the file.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.12 Data Analysis Report Files

Test-time and post-test data analysis reports shall contain any analyses performed by the site computer on data collected during a test.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.13 Event Log Files

All significant events shall be logged and time-stamped with clock time and trace time. Significant events include (but are not limited to) system power-up, reset, initiation and termination of setup and testing events, ready to test conditions, end of crank, engine start-up, engine shut-down, control events, operator interventions, beginning and ending of sample periods, beginning and ending of soak periods, and the beginning and ending of emergency shutdowns and other safety events.

No standard format currently exists; therefore, either SAFs or DAFs are required per Section 1.0.4.

1.0.6.14 Pretest Variable Names, Test Engine Identifier File Definition

The following is a listing of data to be input at the time a test engine is installed on one of the dynamometer systems for testing. This listing (Test Engine Identifier - TEI)) will be downloaded from a remote host for each test subject.

The TDAP for both HD Dyno 2 and HD Dyno 4 shall store two “active” TEIs to facilitate rapid switching between test subjects. TDAP shall have a menu selection at test start-up to allow selection of the TEI.

The TEIs shall be automatically reformatted (if required) from the TEXT file format produced by the EPA’s host to the format required by the TDAP.

A subset of these parameters shall be presented to the operator at the time of test initiation for editing as needed. These shall be presented in interactive dialog boxes or a “fill in the blanks” table. The inputs from the previous data entry (usually, the previous test) shall serve as defaults. Bidders shall submit engineering designs for this page(s) to EPA for review prior to acceptance, per schedule of deliverables.

PreTest Configuration Channels

Note: An “*” denotes values to display to the operator at test time to review or change

<u>Variable Name</u>	<u>*</u>	<u>Description</u>
numTest		EPA test number
numDataacqcompRun		Data acquisition computer run number
idDataacqcomp		Data acquisition computer identifier
numTestType		Test type number
datTest		Date on which the test was started
idOps	*	List of the initials of the test operators
idCell		Name of the test cell
flgClutchEna	*	Is the clutch be used for this test?
tqCITT	*	Curb idle transmission torque (= 0 for manual)
timEngFreeidleacc	*	Engine free idle acceleration
timTransTestTot		Total time of the transient test
timDynoLag		Dyno lag time
timThrottleLag		Throttle lag time
flgCvsEna	*	Is the CVS system to be used for this test?
timCvsStab		Time that it takes the CVS system flows to stabilize
numBags	*	Number of bags to be used for this test
timBagTransport		Transport time of exhaust from engine port to a bag
timBagSamp1		Length of time that the first bag fills
timBagSamp2		Length of time that the second bag fills
timBagSamp3		Length of time that the third bag fills
timBagSamp4		Length of time that the fourth bag fills
timPartTransport		Transport time of exhaust from engine port to particulate filter
timAnalyzeCoTransport		Transport time of exhaust gas from engine port to CO analyzer
timAnalyzeCo2Transport		Transport time of exhaust gas from engine port to CO2 analyzer
timAnalyzeHcTransport		Transport time of exhaust gas from engine port to HC analyzer
timAnalyzeNoxTransport		Transport time of exhaust gas from engine port to NOx analyzer
timAnalyzeCh4Transport		Transport time of exhaust gas from engine port to CH4 analyzer
numMapType	*	Type of map to be run: 1 = step map, 2 = ramp map
spEngMapBegin	*	Speed of the engine at the beginning of a map
spEngMapEnd	*	Speed of the engine at the end of a map
tqEngCrank	*	Cranking torque of the engine
flgHanguptestEna	*	Is the hangup test to be run?
numPartFilter	*	Number of particulate filters
flgPartEna	*	(Enable Particulate Sampling System for Test, 0=off, 1=on)
spControlMode	*	(Select Particulate Sampling System Flow Control Mode, 0=fixed flow, 1=proportional flow)

PreTest Configuration Channels (continued)

<u>Variable Name</u>	<u>*</u>	<u>Description</u>
spPartTotalFlow	*	(Set Particulate System Total Flow Rate for Fixed Flow Mode, units=SCMM)
spPartDiluteFlow	*	(Set Particulate System Dilute Flow Rate for Fixed Flow Mode, units=SCMM)
PT_TOTAL_SAMPLE_TIME	*	(Set Particulate System Sample Time, units=seconds)
spPropTotalFlow	*	(Set Particulate System Total Flow Rate for Proportional Flow Mode, units=SCMM)
spDilRatio	*	(Set Particulate System Dilution Ratio for Proportional Flow Mode, units=ratio)
flgPT_AUTO	*	(Select Host or Manual Control for Particulate Sampler System, 0=Manal control, 1=Host control)
flgFilter	*	(Select Single Filter or Multiple Filter Method for PM System, 1=Single Filter, 2=Multiple Filter, Modal)
flgBagEna	*	(Enable Bag Sampling During Test, 0=off, 1=on)
CVS_BAG	*	(Select CVS Bag Pair To Fill During Test, 1=bag pair 1, 2=bag pair 2, 3=bag pair 3, 4=bag pair 4)
flgRestrictionEna	*	(Enable Restriction Check Before Test, 0=off, 1=on)
timCVSTransportTime	*	(Set Transport Delay Time for CVS Bag System, units=seconds)
spFlowControlMode	*	(Select Bag Fill Venturi for CVS Bag System, 1=low bag fill, 2=high bag fill)
flgAnalyzEna	*	(Enable Continuous Emissions Data Collection During Test, 0=off, 1=on)
flgAnalyzRaw_Dil	*	(Select Analyzer Bench Type, 0=dilute emissions, 1=raw gas emissions)
flgES_AUTO	*	(Select Host or Manual Control of Analyzer Bench, 0=Manual control, 1=Host control)
flgES_LAG_TIME		(Set Longest Transport Delay Time for Analyzer Bench, units=seconds)
flgFeedForward	*	(Enable Feed Forward Control for Transient Test, 0=off, 1=on)
numFeedForwardFactor	*	(Select Feed Forward Factor for Transient Test, units=ratio)
MODE_PRE_CAL_FULL	*	(Perform Zero / Span Calibration Before Test, 0=no, 1=yes)
MODE_1_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_2_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_3_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_4_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_5_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_6_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_7_CAL_FULL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)

PreTest Configuration Channels (continued)

<u>Variable Name</u>	<u>*</u>	<u>Description</u>
MODE_8_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_9_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_10_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_11_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_12_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_13_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_14_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_15_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_16_CAL_FULLL	*	(Perform Zero / Span Calibration Before Mode, 0=no, 1=yes)
MODE_POST_CAL_FULLL	*	(Perform Zero / Span Calibration After Test, 0=no, 1=yes)
MODE_PRE_CAL_CHK	*	(Perform Zero / Span Check Before Test, 0=no, 1=yes)
MODE_1_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_2_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_3_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_4_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_5_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_6_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_7_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_8_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_9_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_10_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_11_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_12_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_13_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_14_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_15_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_16_CAL_CHK	*	(Perform Zero / Span Check Before Mode, 0=no, 1=yes)
MODE_POST_CAL_CHK	*	(Perform Zero / Span Check After Test, 0=no, 1=yes)
idEng	*	(Enter Engine ID)
idEngMfrt	*	(Enter Engine Manufacturer)
numEngConfig	*	(Enter Engine Configuration Number)
OPERATOR_ID	*	(Enter Operator Name)
dewpt	*	(Enter Test Cell Dew Point, units= degrees C)
FHCR	*	(Enter Fuel H/C Ratio, units=ratio)
spEngRated	*	(Enter Engine Rated Speed, units=rpm)
tqPeakTorque	*	(Enter Engine Torque at Peak Torque Speed, units=NM)
spEngIdle	*	(Enter Engine Idle Speed, units=rpm)
spEngIntermed	*	(Enter Engine Intermediate Speed, units=rpm)

PreTest Configuration Channels (continued)

<u>Variable Name</u>	<u>*</u>	<u>Description</u>
spEngMaxSafe	*	(Enter Engine Maximum Safe Speed, units=rpm)
tqRatedSpeed	*	(Enter Engine Torque at Rated Speed, units=NM)
numEngStartProc	*	(Enter Engine Starting Procedure, 0=Dynamometer Start, 1=Manual Start)
spEngCrank	*	(Enter Engine Crank Speed For Dynamometer Start, units=rpm)
numEngStopPro	*	(Enter Engine Stopping Procedure, 0=Host Stop, 1=Operator Stop)
pEngExhTarget	*	Engine exhaust backpressure target, kpa
pEngInletTarget	*	Engine intake depression target, kpa
numEngWarmupProc	*	(Enter Engine Warmup Procedure, 0=None, 1=Diesel, 2=Otto, 3=Steady, 4=Torque Curve)
timWarmup	*	(Enter Time for Steady Warmup, units=seconds)
tqEngWarmup	*	(Enter Torque Setting for Steady Warmup, units=NM)
spEngWarmup	*	(Enter Speed Setting for Steady Warmup, units=rpm)
numEngCooldownProc	*	(Enter Engine Cooldown Procedure, 0=None, 1=Time, 2=Stable)
timCooldown	*	(Enter Time for Timed Cooldown, units=seconds)
tqEngCooldown	*	(Enter Torque Setting for Cooldown, units=NM)
spEngCooldown	*	(Enter Speed Setting for Cooldown, units=rpm)

1.0.6.15

List of Standard Channel Names and Units

Channel Name	Channel Description	Units
bscFuel	brake specific fuel consumption	g/KW/hr
conCO2Amb	Ambient CO2 concentration	ppm
conCO2Exh	Exhaust CO2 concentration	ppm
conCOAmb	Ambient CO concentration	ppm
conHCAmb	Ambient HC concentration	ppm
conHCExh	Exhaust HC concentration	ppm
conHCOExh	Exhaust High CO concentration	ppm
conLCOExh	Exhaust Low CO concentration	ppm
conNOXAmb	Ambient NOX concentration	ppm
conNOXExh	Exhaust NOX concentration	ppm
conO2Exh	Exhaust O2 concentration	ppm
DataTag	Data label	unitless
DIPW1kbd	engine control channel	ms
DIRailDC	engine control channel	unitless
DIRailPDes	engine control channel	bar
DIRailPres	engine control channel	bar
DISOIkbd	engine control channel	degBTDC
effBThermal	Brake Thermal Efficiency	%
EGR	RPECS channel	unitless
EGRcalc	calculated EGR	%
LambdaPostCat	Measured lambda Post cat	lambda
LambdaPreCat	Measured lambda Pre cat	lambda
LPBPPos	engine control channel	unitless
LPBPPosDes	engine control channel	unitless
LPBPPosDesKbd	engine control channel	unitless
LPBPPosDesAuto	engine control channel	unitless
MAF	mass air flow RPECS channel	g/s
MAP	manifold absolute press RPECS	kPa absolute
MAPDC	engine control channel	unitless
MAPDCKbd	engine control channel	unitless
numMode	Mode Number	unitless
numNModeStep	auto N Mode Step	unitless
pCellAmbient	Barometric pressure	kPa absolute
pCompressorIn	Turbo press in compressor side	kPa
pCompressorOut	Turbo press out compressor side	kPa
pCVS	pressure at CVS venturi	kPa absolute
pEngOil	Engine Oil Pressure	kPa
pExhPostCat	Exhaust pressure Post Cat	kPa
pExhPreCat	Exhaust pressure Pre Cat	kPa
pFuelRail	fuel rail pressure	bar
pIntake	Intake manifold pressure/vacuum	kPa

Channel Name	Channel Description	Units
PIPW2	engine control channel	ms
PIPW3	engine control channel	ms
PIPW4	engine control channel	ms
PIPWCylMult1	engine control channel	unitless
PIPWCylMult2	engine control channel	unitless
PIPWCylMult3	engine control channel	unitless
PIPWCylMult4	engine control	unitless
PISOI	engine control channel	degBTDC
pMAP	manifold absolute pressure	kPa absolute
powEng	Engine Power	KW
pTurbineIn	turbo press in turbine side	kPa
pTurbineOut	turbo press out turbine side	kPa
qmFuel	mass fuel rate to engine	gram/sec
qmIntakeAir	Mass air Flow	g/s
qvCVS	total volumetric flow of CVS	SCMM
SpaceVelocity	space velocity thru trap	hr-1 @ STP
SparkCylOffset1	engine control channel	CAD
SparkCylOffset2	engine control channel	CAD
SparkCylOffset3	engine control channel	CAD
SparkCylOffset4	engine control channel	CAD
spDyno	dyno speed	rpm
tCatIn	Catalyst in temp	degC
tCatMid	Catalyst temp mid bed	degC
tCatOut	Catalyst out temp	degC
tCellAmbient	Ambient temp	degC
tCellDewPt	Dew Point Temp	degC
tCompressorIn	Turbo temp in compressor side	degC
tCompressorOut	Turbo temp out compressor side	degC
tCoolantIn	Enging Coolant temp Out	degC
tCoolantOut	Engine Coolant temp In	degC
tCVS	temp at CVS venturi	degC
tCVSSample	temp at dilute sample point	degC
TestTimer	Test Timer	sec
tExhMan1	Exhaust Manifold temp Cyl 1	degC
tExhMan2	Exhaust Manifold temp Cyl 2	degC
tExhMan3	Exhaust Manifold temp Cyl 3	degC
tExhMan4	Exhaust Manifold temp Cyl 4	degC
tExhOrifice	temp at exhaust orifice	degC
tFuel	Fuel Temp	degC
tInterCoolerIn	Intercooler in temp	degC
tInterCoolerOut	Intercooler out temp	degC
tOilSump	Engine oil sump temp	degC
tPartFilterFace	Particulate sample temp	degC
tqDynoCase	torque measured at dyno case	Nm
tqShaft	torque measured at shaft	Nm
tTurbineIn	turbo temp in turbine side	degC
tTurbineOut	turbo temp out turbine side	degC

Channel Name	Channel Description	Units
bsmCO	brake specific CO	g/kWhr
bsmCO2	brake specific CO2	g/KWhr
bsmHC	brake specific HC	g/KWhr
bsmNOx	brake specific NOx	g/KWhr
effBThermalCB	carbon balance efficiency	%
pBMEP	pBMEP	bar
SmokeNum	smoke number	FSN
SOI_Actual	engine control channel	CAD BTDC
conCOExh	Exhaust CO concentration	ppm
LambdaCalc	calculated lambda	lambda

Channel Naming - Prefix Convention

acc	acceleration	m/s^2
con	concentration	ppm
dat	date	days since Jan 1, 1900 (if number); Julian calendar date (if string)
den	density	g/l
f	frequency	Hz
flg	binary flag	1 or 0, TRUE or FALSE
i	current	a
id	identifier	
m	mass	gm
mi	moment of inertia	
num	non-negative integer	
p	pressure	kPa
qm	mass flow rate	gm/s
qms	specific mass flow rate	gm/kWhr
qv	volumetric flow rate	l/s
seq	sequence number	
sp	angular velocity	rpm
spg	specific gravity	
t	temperature	Deg C
ta	absolute temperature	Deg K
tim	time	seconds
v	voltage	v
vol	volume	cc
x	position	m
xr	relative position	%FS

1.0.6.16 Constants and Specialized Calculations

<u>Standard Constants</u>				
	diesel	methanol	ethanol	gasoline
stoic (A/F)	14.5	6.47	9	14.7
hvFuel (kJ/g)	43.073	19.7	26.8	42.9
FID response factor	1	1.28	1.195	1
FracFuel C	0.8655	0.3745	0.522	0.8664
exhaust HC density (g/m3)	574.6	1332	1915	576.8
x for dilution factor	not appl.	1	2	not appl.
y for dilution factor	not appl.	4	6	not appl.
z for dilution factor	not appl.	1	1	not appl.
fuel specific gravity	varies	not used	not used	not used

Processor Equations for Display of Continuous Data

units: power(kW), torque(NM), flows(g/s), analyzers(ppm)

*ctw power calculation per ATD (M Delduca) paper dated Jan 02 in KW
 $\text{powEng} = (\text{spDYNO} * \text{tqDynoCase} * 0.001 * 2 * 3.14159) / 60$

*ctw ATD thermal efficiency calculation per M Delduca paper dated Jan 02
 $\text{effBThermal} = (\text{powEng} / (\text{qmFuel} * \text{hvFuel})) * 100$

*ctw ATD lambda calc per M Delduca paper dated Jan 02
 $\text{LambdaCalc} = (\text{qmIntakeAir} / \text{qmFuel}) / \text{Stoic}$

*ctw pBMEP calc in bar per R Sun paper dated 2-13 and 2-15-02, engine
displacement (Liters) per BP

$pBMEP (2 * 3.142 * 2 * tqDynoCase) / 1.8962 / 100$

*ctw EGR calculation 2 approved methods per M Deluca paper dated Jan 02

$EGR_{calc} (conCO2Intake - conCO2Amb) / (conCO2Exh - conCO2Amb) * 100$

or

$EGR_{calc} (O2Int - 20.7) / (O2Exh - 20.7) * 100$

Here is the code that shows the FID response correction for the alcohol fuels per B Pigeon paper 12-27-01

*ctw if the ambient probe is selected, update the ambient emission

* channels (2 second average) used for background correction

```
#if (doMexaAmbSelect = 1)
    conCOAmb BOXCAR (conLCO 2)
    conNOXAmb BOXCAR (conNOX 2)
    conCO2Amb BOXCAR (conCO2 2)
    conHCAmb (BOXCAR (conHC 2)) * FIDresponse
#endif
```

*ctw if the heated probe is selected, update the exhaust emission

* channels; else make them 9999

```
#if (doMEXA_HEATPROBE_VALVE = 1)
    conCOExh conLCO
    conNOXExh conNOX
    conCO2Exh conCO2
    conHCExh (conHC * FIDresponse)
#else
    conCOExh 9999
    conNOXExh 9999
    conCO2Exh 9999
    conHCExh 9999
#endif
```

*ctw check fuel type and calculate NOx humidity correction using the appropriate equation per CFR

#if (compare(FuelType "diesel"))

kh 1 / (1 - (0.0182 * ((SpecificHumidity) - 10.71)))

#else

kh 1 / (1 - (0.0329 * ((SpecificHumidity) - 10.71)))

#endif

*ctw concentration calculations corrected for background per CFR and C Ryan paper dated 11-29-01

CorrectedHC (conHCExh - (conHCAmb * (1 - 1/DF)))

CorrectedCO (conCOExh - (conCOAmb * (1 - 1/DF)))

CorrectedNOx (conNOxExh - (conNOxAmb * (1 - 1/DF)))

CorrectedCO2 (conCO2Exh - (conCO2Amb * (1 - 1/DF)))

*ctw calculate brake specific emissions and carbon balance

*ctw brake specific emissions per CFR and C Ryan paper dated 11-29-01

*ctw carbon balance efficiency equations per R Sun 2-13-02

*ctw brake specific emissions in g/kwhr

*ctw calculate bsm emissions only if dilute exhaust probe is selected else 9999

#if (doMEXA_HEATPROBE_VALVE)

bsmHC ((qvCVS * 60 * densityHC * (CorrectedHC/1000000))/((spDyno * tqDynoCase)/9549.3))

bsmCO ((qvCVS * 60 * 1164 * (CorrectedCO/1000000))/((spDyno * tqDynoCase)/9549.3))

bsmCO2 ((qvCVS * 60 * 1830 * (CorrectedCO2/1000000))/((spDyno * tqDynoCase)/9549.3))

bsmNOx ((qvCVS * 60 * 1913 * kh * (CorrectedNOx/1000000))/((spDyno * tqDynoCase)/9549.3))

qmExhHC bsmHC * powEng / 3600

qmExhCO bsmCO * powEng / 3600

qmExhCO2 bsmCO2 * powEng / 3600

qmFuelCB ((qmExhHC*FracFuelC) + (qmExhCO*0.4286) + (qmExhCO2*0.2727))/(FracFuelC)

```

    EffBThermalCB powEng/(hvFuel*1000)/qmFuelCB*1000*100
#else
    bsmHC 9999
    bsmCO 9999
    bsmCO2 9999
    bsmNOx 9999
    EffBThermalCB 9999
#endif

*ctw here is the code that checks the fuel type and assigns the constants and dilution
factor equation
*ctw check fuel type and assign constants
#if (compare(FuelType "methanol"))
    densityHC 1332
    Stoic 6.47
    hvFuel 19.7
    FracFuelC 0.3745

    FIDresponse 1.28
    x 1
    y 4
    z 1
    DF 100 * (x/((x + (y/2) + 3.76*(x + (y/2) - (z/2)))))) / ((conHCExh + conCOExh +
conCO2Exh) * 0.0001)
#endif
#if (compare(FuelType "ethanol"))
    densityHC 1915
    Stoic 9.0
    hvFuel 26.8
    FracFuelC 0.522
    FIDresponse 1.195
    x 2
    y 6
    z 1
    DF 100 * (x/((x + (y/2) + 3.76*(x + (y/2) - (z/2)))))) / ((conHCExh + conCOExh +
conCO2Exh) * 0.0001)
#endif

```

```

#if (compare(FuelType "diesel"))
  densityHC 574.6
  Stoic 14.5
  hvFuel 43.073
  FracFuelC 0.8655
  FIDresponse 1.00
  DF (134000 / (conHCExh + conCOExh + conCO2Exh))
  x 0
  y 0
  z 0
#endif
#if (compare(FuelType "gasoline"))
  densityHC 576.8
  Stoic 14.7
  hvFuel 42.9
  FracFuelC 0.8664
  FIDresponse 1.00
  DF (134000 / (conHCExh + conCOExh + conCO2Exh))
  x 0
  y 0
  z 0
#endif

```

*ctw here are the equations to calculate specific humidity per W Courtis paper dated 11-24-97

*ctw calculations for NOx humidity factor per W Courtois paper dated 11-24-97

$$\begin{aligned}
 & t_{\text{CellDewPtVaisK}} (t_{\text{CellDewPt}} + 273.15) \\
 & D (t_{\text{CellDewPtVaisK}}) \\
 & p_{\text{CellAmbientmb}} (p_{\text{CellAmbient}} * 10) \\
 & p_{\text{SatDewmb}} (0.01 * \text{EXP}((2.858487 * \text{LOG}(D)) - (2991.2729 / (D^2)) - (6017.0128 / D) + 18.87643854 - (0.028354721 * D) + \\
 & \quad (0.000017838301 * D^2) - (0.00000000084150417 * D^3) + \\
 & \quad (0.00000000000044412543 * D^4)))
 \end{aligned}$$

EnhanceDew $(1 + 0.00041 + pCellAmbientmb * (0.00000348 + 0.000000000074 * (tCellDewPtVaisK - 273.15 + 30.6 - (0.038 * pCellAmbientmb))^2))$
 pSatDewCorrectedmb $(pSatDewmb * EnhanceDew)$
 SpecificHumidity $((0.6220 * pSatDewCorrectedmb * 100) / ((pCellAmbientmb * 100) - (pSatDewCorrectedmb * 100))) * (1000)$

Appendix E

Pressure Transducer Specifications

The following is a listing of the pressure transducers to be used in test site instrumentation, along with their ranges:

- 1 ea. -10 to +10"H2O water column
- 3 ea. 0 to 15 psig
- 1 ea. 0 to 25 psig
- 1 ea. 0 to 50 psig
- 4 ea. 0 to 100 psig
- 1 ea. 0 to 250 psig
- 1 ea. 17 to 32 inches Hg (barometer)
- 1 ea. -14.7 to +35 psig

The above transducers shall minimally meet the following specifications:

- | | |
|----------------------|-----------------------------------|
| Accuracy RSS | ± 0.11% FS (constant temperature) |
| Non-linearity (BFSL) | ± 0.1 % FS |
| Hysteresis | 0.05% FS |
| Non-repeatability | 0.02 % FS |
| Compensated range | 32 to 150 (degrees F) |
| Vibration | 2g from 5Hz to 500 Hz |

Appendix F

Supplemental Requirements for Time-of-Operation Quality Monitoring and Reporting

All continuous and time of operation quality requirements for parameters monitored, measured and/or controlled by the system outlined in this Statement of Work in accordance with CFR requirements, shall be monitored against those CFR requirements, with additional modification and supplementation as found below.

Real-time sample proportionality within 2% of nominal for all sampling not accomplished via critical flow devices. Critical flow devices shall be monitored for maintenance of choke flow conditions.

Exhaust back pressure at rated conditions (steady state test only) within \pm limits of engine specification.

Air inlet restriction at rated conditions (steady state test only) within \pm limits of engine specification.

Phase (Sample) Time within 1 seconds of nominal, as adjusted for transport delay times

Subsystem Status OK

Diluent Concentrations (Ambient Air)

HC	2.4 to 6.9 PPM (carbon)
CO ₂	0.030% to 0.050%
CH ₄	1.6 to 2.7 PPM
NO _x	0.0 to 0.8 PPM
CO	0.0 to 2.5 PPM

Sample readings within 105% of calibrated range of analyzer

Sample readings within 20 minutes of sample completion

Zero/span results ok

Continuous Specific humidity between 35 and 55 grains/pound

Cell ambient temperature between 70 and 82 degrees F

Leak checks performed and passed within last 15 clock hours from start of test

System calibration and traceability status “OK” as defined by time interval and successful completion of calibration procedure

Post-test Quality Control Report

The Post-Test Quality Control report shall report on all time of test quality monitoring results tailored for the specific test performed. At a minimum the report shall include a header that contains the following information.

1. Test number
2. Date of test
3. Start time of test
4. End time of test
5. Engine ID
6. EPA test site designation
7. Test type
8. Limit table designation

Beneath the report header shall be a statement of the quality monitoring result, as appropriate. The statements shall include the following or similar wording:

“All automatically monitored quality requirements were met”.

Or

“Warning, this test did not meet certain automatically monitored quality requirements, as indicated by flags below:”

Operator-entered Quality Control Report remarks shall appear directly beneath the quality summary statement.

The report shall include a summary of the minimum, maximum, average and pass/fail conditions for all CFR parameters, as relevant for the specific test configuration. The report shall be easily configured to include the minimum, maximum and average value for any other continuous data collected by TDAP.

The report shall also include the following:

1. Indication as to whether the CVS remained in choke flow during the test
2. Indication as to whether required leak checks had been performed in the last 15 hours
3. All system warnings issued during the test
4. Summaries and pass/fail indications of cycle performance
5. Pre-test shunt cal check of torque transducer - result and pass/fail indication
6. Sample phase times within required limits
7. Ambient dilution air concentrations of HC, NO_x, CO₂, CO, Methane were within limits
8. Average barometric pressure during MAP and test just completed and pass/fail indication
9. All bag analysis times were less than 1200 seconds
10. All zero and span checks were within limits
11. Sample concentrations of CO₂ were within reasonableness limits
12. All measurements were made in the calibrated range of the device
13. All instrument zero span measurements and corrections
14. Other contractor-recommended parameters, including those made significant by the design and functioning of the measurement system

For parameters listed in the minimum, maximum and average condition section, the system shall provide for separate limits for instantaneous and average levels. Instantaneous values may be filtered or averaged, if required, to provide a more representative assessment. The contractor shall specify all signals, which are filtered or averaged in association with this monitoring function, in their system documentation.

Statutory limits shall be utilized in the monitoring function where applicable, unless other limits are specified in this Statement of Work. Where monitored parameters are not governed by statutory limit, the contractor shall propose limits based on engineering judgement relevant to the influence of the parameter on the test outcome. All limits shall be stored in separate tables or files. The tables shall be easily modifiable within the set functions available at the highest security level.

The associated Limit Table shall be stored and printable as part of the post test Quality Control Report, in accordance with ISO standards.

Appendix G

Supplemental Engine Emission Report Data

Engine Specific Data

Engine Configuration:

Engine Displacement:

No. of Cylinders:

Governor Type:

Transmission Type:

Idle Torque (Nm) [ft-lb]:

Engine Map ID:

Engine Map Date:

Engine Map Time:

Spec Power (kw) [hp]:

Spec Idle Speed (rpm):

Spec Rated Speed (rpm):

Test Specific Data

Fuel Type:

Fuel H/C Ratio - FHCR

Total Cycle Time (sec.)

CVS Total Flow (SCM) [SCF]

Saturated Vapor Pressure (mB)

Saturated Vapor Pressure (mB) [kpa]

Relative Humidity (%)

Specific Humidity (g/kg)

Dilution Factor - DF

Map Barometer (mB) [kpa]

Test Barometer (mB) [kpa]

Crank Time (sec.)

Dewpoint Temp. (°C)

Air Intake Temp. (°C)

Max Torque (Nm) [ft-lb]

Min Torque (Nm) [ft-lb]

Max Speed (rpm)

Min Speed (rpm)

Emissions Analysis

Note- Per phase or mode summary and integrated test result

Note- Continuous, bag, and difference

Note- Mass and Brake-specific mass emissions

Power (kw-hr) [bhp-hr]:

Measured BSFC (kg/kw-hr) [lb/bhp-hr]:

Phase Start/End Time

Calculated BSFC (kg/kw-hr) [lb/bhp-hr]:

HC mass (grams)

NOx mass (grams)

CO mass (grams)

CO2 mass (grams)

CH4 mass (grams)

NMHC mass (grams):

Humidity Correction Factor - KH

Wet/Dry Correction - KW

CVS volume

Particulate Analysis

Note- Per phase summary and integrated test result

Note- Mass and Brake-specific mass

Note - Summarized per each filter set

Note - Multiple filter sets per phase or mode possible

Note - Primary and secondary or single filter only

Filter ID Number:

Pre-Test Weight:

Post-Test Weight:

Filter Weight Gain:

Exhaust Particulate Flow (SCM) [SCF]

Total Particulate Weight (grams)

Brake Specific Weight (g/kw-hr) [g/bhp-hr]

Appendix H

Combustion Analyzer Specifications

This system is used to analyze engine combustion processes by measuring engine cylinder pressure waveforms and crankshaft rotation signals.

The following is a listing of specifications for the optional combustion analysis system, as described in Section 8.3 of the statement of work.

A. Combustion Analysis

1. Computes indicated Mean Effective Pressure (IMEP) for each cylinder (up to a minimum of 12 cylinders total), each cycle. These computations shall be in real-time.
2. Computes (real time) additional individual-cycle combustion parameters for the selected cylinders, as follows:
 - Low IMEP
 - Pumping Mean Effective Pressure (PMEP)
 - Net Mean Effective Pressure (NMEP)
 - Misfire (including IMEP percent misfire and total IMEP misfire)
 - Peak pressure
 - Maximum rate of pressure rise
 - Location of pressure event vs. crankshaft rotation
 - Polytopic coefficients of expansion and compression
 - Upper, lower, and average pressure envelopes
 - Injector start and duration (both crank angle and time)
 - Mass Fraction Burn and Mass Burn Rate
 - Engine averages of IMEP, NMEP, peak pressure, max. rate of pressure rise, and their location vs. crank angle.
 - Knock intensity and peak
3. Computes (real time) minimum, maximum, mean, standard deviation, COV, and LNV of combustion analysis using moving window analysis.
4. Individual statistical calculations can be enabled for every real time calculation.
5. Displays (real time) calculated combustion parameters as they occur.
6. Outputs (real time) analog representations of selected combustion parameters for external oscilloscopes and strip charts (real and/or virtual).

7. Logs and correlates (real time) up to 64 megasamples (128MBytes) of raw and/or calculated combustion parameters for post-test analysis.
8. Displays on-line scope traces of raw signals, either from the crankshaft encoder or from a time base. Also supports logP-logV. Also displays oscilloscope traces of processed signals such as heat rise rate curves, burn curves, etc.
9. Supports
 - Up to at least 12 cylinders
 - Unequal firing intervals
 - 2 or 4 cycle spark ignition or compression ignition engines, including pilot injection.
 - 0.1 degree crankshaft encoder, any make. Must also accommodate signals from the engine flywheel.
 - gasoline, Diesel, ethanol, methanol, and propane engine fuel
10. Supports multiple real-time processor for increased computational throughput.
11. Data decimation allows monitoring and/or recording of raw signals at different encoder resolutions in different parts of the engine cycle.
12. Monitoring of real-time combustion parameters is continuous and not disrupted by logging of data.
13. A context-sensitive help function shall be provided.
14. An engineering unit conversion facility allowing display of data in any appropriate unit shall be provided.
15. Displays are set up and modified by the user from a toolbox of graphical display elements.
16. A data viewing utility will provide plots of all collected data for immediate review.
17. Data can be converted to file formats compatible with Lotus, Asyst, PCMATLAB, IFEF, IB/1 floating point, DIA, PJAS, and ASCII.

B. Knock Analysis

The combustion analysis system shall quantify knock on a cylinder-by-cylinder and cycle-by-cycle basis. Cylinder pressure signals shall be filtered to isolate knock frequencies. Intensity and peak value analysis shall be performed for each engine cycle. Simultaneous acquisition of standard combustion data shall allow for cycle-by-cycle correlation.

C. Hardware

The system shall consist of the hardware required to operate the system (for example, a Windows PC & VXI crate and boards, or a stand-alone system), and all necessary support equipment (charge amplifier, in-cylinder pressure sensor, encoder, wiring etc.). Adequate support equipment shall be provided to support instrumentation of one cylinder per provided system. Data acquisition boards and/or any other computer peripherals required for system function shall be supplied by the contractor. The system can either be contained in a PC chassis with any required boards in a small crate-type chassis (for example, HP VXI), or may be delivered in a stand-alone 19" rack-mounted cabinet. This system shall be interfaced with the TDAP computer described in Section 2.2 of the Statement of Work.

The TDAP interface shall, at a minimum, enable the following function control:

- Full control of the combustion analysis system
 - Manual or programmed in TDAP
 - Start of sample
 - End of sample
 - Pause
- Download of test data, including supporting data (date, time, engine ID, etc.)
- Continuous real-time processing
- Direct Ethernet interface to PC or stand-alone system
- Display screen and keyboard
- 64 channels of high speed external analog input
- 16 TTL inputs
- 8 low speed AID inputs
- 8 D/A outputs
- 8 TTL inputs
- Up to 5 real-time floating point processors
- Up to 64 Msamples of raw data storage
- Block mode decimation of raw data

1. Analog Input Module

The analog input module shall accept high speed, crank-angle based signals and convert them to digital values. The values shall be either stored and used simultaneously for real-time calculations or stored for future analysis.

Minimally, the analog input module shall conform to the following specifications:

- 16 analog to digital (A/D) channels per module
- 14 bit, 1 Msample/channel conversion rate
- Programmable gains for each channel
- Self-calibration and diagnostics
- Compatible with EPA supplied charge amplifiers, as well as the charge amplifiers supplied under this contract.

2. Charge Amplifiers/ In-Cylinder Pressure Transducers

The contractor shall provide one charge amplifier per system, functionally identical to Kistler Type 5010B. One in-cylinder pressure transducer shall be provided per system, compatible with the above charge amplifier.

3. Interface Boards and Cables

Any required interface boards and cables shall conform to the following specifications:

- Chassis for any boards shall be 19" rack mount (or adaptable, adaptors to be provided)
- Boards shall be compatible with the above chassis
- Cables and connectors shall be provided - lengths to be determined by the contractor based on site installation of components
- Cables shall be compatible with the charge amplifiers (connectors, resistance, etc.)

D. System Software

1. Graphical User Interface (GUI)

A GUI shall be provided. Preference shall be given to systems that provide the GUI through the TDAP, but other contractor-supplied hardware (for example, a Windows PC) may meet this requirement. Minimally, the GUI shall provide the following:

- Flexible screen configuration
- Context sensitive help
- Gages, bars, values, strip charts, oscilloscopes
- Screen elements that indicate out-of-tolerance events

2. Overall Data Acquisition and Storage

- Real time calculation of results with statistics
- Envelopes
- Raw data shall be saved either pegged or unpegged
- Process pressure curves (trace calculations) shall be saved

3. Communication and Integration

- The system shall be able to send data to and from the test site IFC (see specifications in Attachments C and D)
- Real time results shall be displayed

Appendix I

Schedule of Deliverables

The project management shall include the following submissions, milestones and events to be completed no later than the indicated dates, relative to the contract award date or exercise option date. Where dates are not shown, the contractor shall propose appropriate dates at the Project Kickoff Meeting. All days are calendar days.

HD Dyno 2 or 4

The following schedule shall also apply to the option for a third system.

Project Kickoff Meeting and Site Survey (25 days)

Project Programming

Project Management

Technical exchange meetings and approvals

Quality Assurance

Status Report/Open Item Tracking

Weekly Status Report/Open Item Tracking Submission (Starting after project kickoff)

Preliminary Design Submission and Review Meeting (75 days)

Test cell layout, equipment design and layout, functional specifications

EPA Preliminary Design Approval

Submission of Automated Function specifications and implementation plan for approval

Submission of Standard-Function Report Layouts for Approval

Submission of Pretest Data Entry and Test Set-Up Screens for Approval

Submission of Calculation Verifications for Approval

Submission of Preliminary Equipment Qualification Results to EPA (200 days)

Calibration Results

Repeatability/Stability Test

Submission of Calibration Reports and Measurement Traceability Documentation

Submission of Acceptance Plan for Approval

Contractor-Site Acceptance Testing (230 days)

Submission of Summary Report of Contractor-Site Acceptance Results

Submission of Installation Material Data Safety Information to EPA for approval and Equipment

Delivery Date Confirmation to EPA

EPA Authorization to Ship

EPA-Provided Contractor Safety Training

Equipment Delivery to EPA (260 days)

Equipment Installation and Commissioning (310 days)
Final Acceptance Testing (340 days)
Training and Submission of all Documentation (360 days)
Final EPA Approval

ATTACHMENT 3

TECHNICAL PROPOSAL INSTRUCTIONS

Test Cell Controllers and Engine Dynamometers for EPA/NVFEL

Technical Proposal Instructions

General Requirements

The contractor shall submit an original and three (3) copies of its technical proposal.

The contractor's proposal shall include a list of system electrical requirements, including specific requirements for voltage, amperage, phase and requirements for clean power. The proposal shall include a list of system electrical requirements, including kVA and kW required, amperage per phase, and number of phases required for each type of power. Requirements for equipment loads exceeding 3kW or loads with high inrush current shall be separately identified in the proposal.

Electrical loads greater than 1kW, and with a power factor less than 0.8, shall be identified in the proposal. Any unusual requirements for electrical power or equipment grounding shall be identified

Specific Requirements

(1) The contractor's proposal shall address all minimum requirements set forth in the Statement of Work, and also explain any way its proposed solutions would enhance the performance of the delivered dynamometers and cell controller/data acquisition systems beyond the minimum requirements. **Proposals shall be structured in a manner, that clearly and specifically addresses each individual requirement**, in the same order and general format in which they are presented in the Statement of Work.

(2) The following instructions are intended to further define certain information critical to proposal evaluation.

- 2(a) The contractor shall provide its detailed dynamometer performance, capacity and capability specifications. These specifications shall also include pertinent details of the measurement methods used to generate the specification, such as the type of test utilized, any averaging employed, and statistical details, such as level of confidence. For the dynamometer specified in Section 2.3.20 of the Statement of Work, preference will be given to dynamometers with higher maximum speed ratings, up to 6,000 RPM. For bidding purposes, it can be assumed that the interface requirements for the optional third system will be no more complex than the interface described in this document for HD Dyno 2.
- 2(b) The contractor shall describe how it achieves excellent closed loop control of the engine and dynamometer during transient testing, including any tools for efficiently achieving acceptable

cycle performance. Preference will be given to systems that accomplish closed loop control with control models that optimize response of the engine and dynamometer as a system.

- 2(c) The contractor shall provide a summary of its safety, health and environmental considerations in its proposals.

The contractor shall provide a Quality Assurance Plan showing how it will assure compliance with contract requirements and how the products delivered will support a system of on-going quality assurance. The contractor shall describe its general approach to run time quality control in their proposals. The specific equipment acceptance requirements contained in Section 5 of this Scope of Work shall be included in the Quality Assurance Plan.

- 2(d) In its proposal, the contractor shall explain, and demonstrate with data, the accuracy and precision of its measurement and data acquisition systems, including combustion analysis systems. With respect to combustion analysis systems, preference will be given to systems that indicate the amount of injector needle lift opening in engineering units (mm or inches).

The contractor shall describe any averaging/filtering algorithms used in association with the measurement function of their systems. Preference will be given to systems that also include the ability to calculate torque as a function of dynamometer amperage.

- 2(e) The contractor, in its proposal, shall include a description of other facility related requirements such as temperature, ventilation, etc. This description shall also include data related to any significant heat rejection from the dynamometer and related components

The contractors shall describe and illustrate its proposed test site configurations. Describe and illustrate any special mounting provisions or any associated requirements not provided by the contractor. Describe any other significant, proposed physical modifications to the test site or facility.

- 2(f) In the proposals, the contractor shall describe significant ways that the delivered systems will support operational efficiency, including reliability and maintainability. This shall include any significant ergonomic considerations with respect to physical design and layout and clarity and ease of use of operator interface with automated systems. The contractor shall specify recommended maintenance and calibration intervals.

The contractor shall describe any additional devices, displays, or controls that enhance the setup, operation, quality, safety, and efficiency of the system and can be integrated with the delivered system.

The contractor shall describe and illustrate other auxiliary equipment such as instrument

booms. Preference shall be given to measurement booms featuring modular wiring connections to the data acquisition hardware, access doors and other features for the ease of installing additional components and wiring in the future.

2(g) The contractor shall provide a complete description of computer hardware and operating software in its proposal. The contractors shall detail its proposed computer system interface design and protocols.

(3) In its proposal, contractors shall provide evidence that their dynamometers and cell controller/data acquisition systems have general acceptance in the engine emissions testing industry by listing at least three different certification test laboratories using similar systems for emissions and related measurements. This listing shall include a brief description of each system and a contact name for each laboratory.

(4) The contract shall submit a list of contracts and subcontracts completed which are similar in nature to this requirement. The contracts and subcontracts listed may include those entered into with Federal, State and Local governments, and commercial businesses, which are of similar scope, magnitude, relevance, and complexity to the requirement which is described in the RFP. Provide a point of contact for each cited contract and/or subcontract with the name of the client, telephone number, and period of performance.

(5) The proposal shall include a comprehensive explanation of the management of the project, including a Gantt chart showing major milestones, personnel support plan, plan for monitoring and managing all key activities including installation. The offeror shall specify recommended maintenance and calibration intervals in its proposal.

ATTACHMENT 4

TECHNICAL EVALUATION CRITERIA

Technical Evaluation Criteria
Test Cell Controllers and Engine Dynamometers
for EPA/NVFEL

Evaluation - Commercial Items (FAR 52.212-2) (Jan 1999)

- 1) The Government will award a contract resulting from this solicitation to the responsible offeror whose proposal conforming to the solicitation will be most advantageous to the Government, price and other factors considered. The following factors shall be used to evaluate offers: technical proposal, price, delivery, and previous experience.

The following requirements shall be evaluated on a Best Value basis. Offerors shall provide information to demonstrate / substantiate that the proposal meets the minimum requirements.

Offerors shall:

1. Demonstrate that the proposal meets all the minimum requirements of the Government and fulfills EPA's needs as set forth and described in the Statement of Work and Proposal Instructions.
2. Describe how the proposal meets or exceeds requirements in the following critical aspects:
 - (a). Basic dynamometer performance, including response time, load accuracy and frictional stability, capacity and capability.
 - (b). Configuration of TDAP software for ease of use and adaptability.
 - (c). Integration of Safety and Quality Control provisions to assure system integrity, and high standards of performance on a per test (or other specific operation) basis, including utilization of trend analysis and statistical process control, to alert the user to abnormal conditions.
 - (d). Implementation of a dynamometer system that meets the requirements for accurate and precise measurements.
 - (e). Physical integration of the dynamometer with all aspects of the existing and proposed facility.
 - (f). Implementation of hardware, software tools and processes that meet

requirements for rapidly achieving acceptable transient-test cycle performance on a wide range of engines. Provision and use of any auxiliary equipment, methods, or techniques that are provided to improve efficiency, simplify tasks and assure test validity and integrity.

(g). Implementation and integration of all the test data collection, processing, information management and file transfer, and reporting methods to assure compliance with regulation and accepted standard practices and to facilitate user friendly information management tools.

3. Provide information on previous work that demonstrates experience with fabrication and installation of similar equipment to that described in the Statement of Work. Such information may include drawings, photographs, technical data or papers, catalogs, project management information, etc.
4. Submit a list of contracts and subcontracts completed which are similar in nature to this requirement. The contracts and subcontracts listed may include those entered into with Federal, State and Local governments, and commercial businesses, which are of similar scope, magnitude, relevance, and complexity to the requirement which is described in the RFP. Provide a point of contact for each cited contract and/or subcontract with the name of the client, telephone number, and period of performance.
5. Provide detailed project schedule information and affirmative statements regarding the offeror's ability to meet delivery requirements outlined in the Statement of Work. Demonstrate how the requirements identified in the SOW, such as Section 1.8 (Project Management) will be satisfied to effectively deliver and install required systems. These include, but are not limited to: Project Planning, Scheduling, and Issue Tracking, and an Acceptance Test Plan that addresses Working On-Site at NVFEL, Installation, Commissioning, Acceptance Testing, Warranty, Spare Parts, Documentation, and User Training.

B. Responses to the above factors shall be evaluated on the following scale:

Unacceptable:	Does not meet all requirements of the SOW.
Acceptable:	Meets all minimum requirements of the SOW.
Superior:	Exceeds the Government's minimum requirements.

- C. After the responses have been evaluated against the factors above, an order is expected to be placed with the offeror that represents the **Best Value** to the government. Price may not be the determining factor. Best and final offers should be provided. Discussions may be conducted as necessary at the government's discretion after receipt of quotes and proposals.
- D. A written notice of award or acceptance of an offer, mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer, shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award.

ATTACHMENT 5

QUALITY ASSURANCE PLAN

QUALITY ASSURANCE PLAN

EPA desires on-time delivery and is negatively impacted by a late delivery. As such, late delivery of an acceptable product is to be disincentivized. The following chart details the monetary plan for late delivery.

Deliverable	Receipt of Deliverable	Disincentive	Surveillance Method
Completion of Final Acceptance Testing of the Test Cell Controllers and Dynamometers in accordance with the attached Statement of Work.	Calendar Day 340.	For each calendar day after the 340 calendar day requirement that the Final Acceptance Testing of the Test Cell Controllers and Dynamometers is not completed, the contract price shall be reduced by \$1,000. Maximum disincentive shall not exceed \$70,000.	The contractor will be notified the day of award. The day following contract award will be considered Day 1.

ATTACHMENT 6

CONTRACT LINE ITEMS

Line Item	Description	Qty	Units	Unit Price	Total Price
BASE	TEST CELL 2 AND 4				
0001 A	Heavy Duty Engine Dynamometer for Test Cell 2 in accordance with the attached Statement of Work.	1	Each	\$ _____	\$ _____
0001 B	Engine Test Cell Controller and Data Acquisition System for Test Cell 2 with Safety System Engine Throttle Controller/Positioner, and Test Cell Instrument Boom in accordance with the attached Statement of Work.	1	Each	\$ _____	\$ _____
0001 C	Heavy Duty Engine Dynamometer for Test Cell 4 in accordance with the attached Statement of Work.	1	Each	\$ _____	\$ _____
0001 D	Engine Test Cell Controller and Data Acquisition System for Test Cell 4 with Safety System Engine Throttle Controller/Positioner, and Test Cell Instrument Boom in accordance with the attached Statement of Work.	1	Each	\$ _____	\$ _____
				TOTAL:	\$ _____
OPTIONS					
0002	Engine Test Cell Controller and Data Acquisition System similar to Test Cell 2 with Safety System Engine Throttle Controller/Positioner, and Test Cell Instrument Boom in accordance with the attached Statement of Work.	1	Each	\$ _____	\$ _____
0003	Combustion Analysis System for each system in accordance with the attached Statement of Work.	MAX 3	Each	\$ _____	\$ _____
0004	One (1) Year Extended Warranty for each system in accordance with the attached Statement of Work.	MAX 3	Each	\$ _____	\$ _____
0005	Two (2) Year Extended Warranty for each system in accordance with the attached Statement of Work.	MAX 3	Each	\$ _____	\$ _____